APPENDIX 7-A
US Forest Service
Stanislaus National Forest

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This appendix contains two Forest Service protocols that were used to identify degraded and at risk meadows and road culverts for the Stanislaus National Forest – Upper South Fork Stanislaus River Watershed Restoration and Water Quality Enhancement Project:

Frazier, J. W. 2010. Meadow Hydrologic Function – Rapid Assessment. Protocols for assessing meadow hydrologic condition. Version 2.0. Stanislaus National Forest. Sonora, CA. 15 pp.

Grant, S.L., T. Durston, J.W. Frazier, F. Kuramata, August 2011. Motorized Road and Trail Condition Inventory, Version 3.1. USDA Forest Service, Stanislaus National Forest, Resource Management Program Area. Sonora, CA, 44 pp.

Meadow Hydrologic Function Rapid Assessment

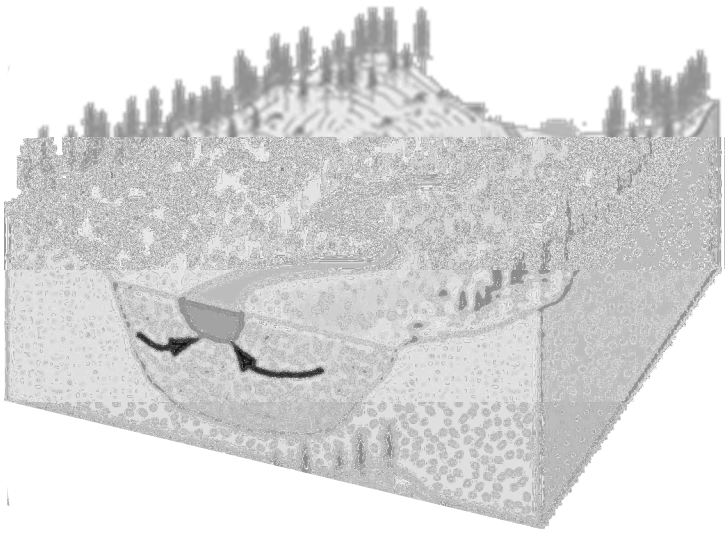
Stanislaus National Forest

United States
Department of
Agriculture

Forest Service

December 2010

Version 2.0



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Introduction

The purpose of this procedure is to rapidly evaluate meadow hydrologic function in the field using five attributes related to the principal plant-soil-water relationships which affect overall meadow condition.

This assessment provides an overview of meadow condition and serves as a basis for more detailed, intensive inventories and monitoring. It allows numerous meadows to be assessed in a short period of time. This has the advantage of simultaneously obtaining information on condition of individual meadows as well as assessment of meadow conditions at a larger scale of interest.

This assessment applies to all meadows that contain a defined stream channel, including perennial, intermittent or ephemeral streams. Thus, it is applicable in nearly all meadows. The assessment is intended to be extensive; that is, it is not fully quantitative or precisely repeatable, and it requires skilled professionals or well trained technicians to assure it is done as accurately as possible. Overall, this assessment is a useful tool because it can quickly obtain information where no previous data exist, and it can be done at a relatively small cost in a short period of time.

This assessment procedure is tiered to the Riparian Conservation Area desired conditions in the Forest Plan Direction (USDA Forest Service 2010). Those desired conditions include the five attributes that are used in this assessment to understand existing condition of meadow hydrologic function – specifically channel morphology, floodplain connectivity, water table status, streambank stability and herbaceous plant community rooting characteristics.

These protocols also tier to two related Forest Service documents that assess condition of streams and riparian areas. These are Streamscape Inventory (SSI) Technical Guide, an extensive survey of stream, aquatic and riparian conditions (Frazier et al 2006), and Stream Condition Inventory (SCI) Technical Guide, an intensive survey and monitoring procedure of stream and aquatic habitat (Frazier et al 2005).

Version 2.0 represent two updates to Version 1.0. First, text revisions were made based on experience using Version 1.0. Second, a fifth attribute was added – regarding the herbaceous plant community – to more fully capture the relationship of water, soil and plants in assessing meadow hydrologic function.

Protocols

Overview

The protocols described below consist of the procedures for assessing and rating the five attributes in the field. The format for the description of these attributes follows those in the Streamscape Inventory and the Stream Condition Inventory Technical Guides.

The rapid assessment may be conducted any time during the field season, and thus can be timed for specific needs. If there is a special interest in floodplain connectivity, it may be advantageous to visit the meadow when the stream is at or above bankfull level to determine whether there is or is not adequate connection between the stream and the meadow surface. If there is an interest in observing annual effects of streamside

use in a meadow (i.e., recreation, grazing, OHV), it may be useful to visit it in the late summer or fall. In some cases, it may be useful to visit the meadow more than once during the field season.

While this assessment is not a precise or intensive procedure it nonetheless has the ability to differentiate hydrologic function condition between meadows. Field experience with Version 1.0 of this protocol (USDA 2006) has shown it is sensitive enough to detect if the hydrologic function of a meadow is at desired condition or any lesser condition ranging from good to very poor. The results of the assessment are suitable for informing decision makers about meadow conditions which may influence their management options.

Because there is a strong interrelationship among the five attributes there can be some overlapping of values rated. For example, floodplain connectivity is closely related to channel form and thus they are often both rated the same in a meadow. However, by assessing them separately it allows necessary variation in rating in the minority of cases where they differ. Similarly, herbaceous plant community is usually but not always closely tied to water table alteration. And streambank stability is related to all other attributes. None of the attributes receives a higher weighting than another because they all have interrelating values that form the outcome of the assessment.

Field Survey Procedure

In each meadow, the stream channel is walked from the lower to the upper end of the meadow and back again. During the upstream survey, observations are made of channel form, floodplain connectivity, water table status, streambank stability and plant community characteristics. On the downstream survey each attribute is reviewed again before it is assigned a rating. During this time, additional evaluation is made to assess conditions where there may be a question about the potential rating, including measuring attributes as needed.

Meadows with multiple streams may be assessed individually or combined as an overall rating based on the assessor's judgment of whichever best describes the situation. Meadows with multiple components may be subdivided for assessment purposes. For example, meadows may be subdivided into "west" and "east" or "upper" and "lower."

Once the assessment is complete, the condition of each attribute is rated on a scale of 1-3. The scores for each attribute are added to obtain a summary score for the meadow. The meadow is then assigned an adjective rating, ranging from desired condition to very poor, based on the summary score. See the attached field data sheet for an example of rating procedures.

Attributes

Channel Form

Importance

The cross-sectional shape of a stream channel is an indicator of its condition. While all streams are incised into the landscape they occupy, their depth and width – principal attributes of shape - can be an important factor in understanding current condition and causative processes or effects of management activities. Streams in meadows should have a relatively small cross-sectional area – essentially a low flow channel that carries low stream flows, leaving high flows to spill out and dissipate energy on the floodplain.

Objective of This Measurement

Determine the form of the channel in the meadow.

How Many Measurements to Take

Take one measurement per stream segment evaluated. This may be the entire meadow length, or subdivisions based on changes in channel configuration.

Where to Take the Measurement

Continually observe the shape of the channel while assessing the meadow.

How to Take the Measurement

For each stream in a meadow, or each segment of a stream if the stream is subdivided for assessment, record the correct percentage class for the length of the stream that is within Channel Form Class 1 below. The percentage classes are shown on the data form. (The four channel classes shown below follow the protocol in the Streamscape Inventory Technical Guide, and are provided here for context of various channel conditions compared to a normal channel).

1. Normal – No active downcutting or obvious evidence of accelerated past incision. This channel form can occur in all channel types but is most common in channels resistant to incision, such as where the streambed and banks are armored by cobble, boulder or bedrock. A normal channel is one viewed as not excessively incised into the landscape. Channel morphology is within the appropriate range for the stream type (i.e., width-to-depth and entrenchment ratios (Rosgen 1996), bank angle). Streambanks and streamside areas are usually well vegetated and/or have cover resistant to erosion (i.e., boulders or bedrock, tree or shrub roots, large embedded wood in streambanks).
2. Incised – Active downcutting or evidence of accelerated past incision is present. This condition is most common in low gradient reaches where finer textured bed and bank materials are present, although steeper gradient sections with small substrate can have this same appearance. These stream segments appear gullied, and have lost connection with their former floodplain. They are usually narrow, single thread channels that have not yet "bottomed out" at a new base level. Channel morphology is altered from the appropriate range for the stream type (i.e., width-to-depth and entrenchment ratios, bank angle). They often have over-steepened channel slopes with poor streambank stability (lack of ground cover).

3. Incised and widened – These channel segments have bottomed out and subsequently widened. They have not developed a new floodplain. The channel may be braided in some areas. There is often little or no pool formation. Channel morphology remains altered from the appropriate range for the stream type (i.e., width-to-depth and entrenchment ratios, bank angle). They often have over-steepened banks and insufficient ground cover on the streamside slopes.
4. Rejuvenating – These are channel segments that have downcut and widened in the past but are currently reforming or have reformed into a stable channel at a new base level. Rejuvenated channel segments usually occur in low or moderate gradient reaches with relatively small streambed particle sizes. Rejuvenation is evidenced by increasing floodplain and meander pattern redevelopment, and increasing pool formation. Channel morphology has returned to or is approaching the appropriate range for the stream type (i.e., width-to-depth and entrenchment ratios, bank angle). The over-steepened slopes adjacent to the channel from the initial incision are in the process of sloping toward the angle of repose, and re-vegetation is occurring on at least some these locations.

Note:

The channel form classes in this protocol can be "crosswalked" with stream condition "states" in A User Guide to Assessing Proper Functioning Condition and the Supporting Sciences for Lotic Areas (USDI 1998). That document shows the relationship between this rapid assessment method and the procedure for assessing Proper Functioning Condition.

Floodplain Connectivity

Importance

A meadow stream in a normally functioning condition will flood some distance out onto the meadow surface. The frequency and amount of flooded area varies with annual runoff. However, the process is important because flooding deposits sediment to help maintain a healthy meadow, builds streambanks and dissipates high-flow energy across part of the meadow and minimizes channel erosion. If a meadow stream is enlarged (such as incised and/or widened channel forms in the previous attribute), the stream confines most flows within the channel and results in degraded meadow conditions (i.e., excessive channel erosion).

Objective of This measurement

The objective is to determine how much of the stream channel in the meadow has floodplain connectivity.

How Many Measurements to Take

Take one measurement per stream segment evaluated. This may be the entire meadow length, or subdivisions based on changes in channel configuration.

Where to Take the Measurement

Continually observe the entrenchment of the channel while assessing the meadow.

How to Take the Measurement

Observe the cross-sectional configuration of the channel while walking the channel. For floodplain connectivity, the channel level should be very near the surface of the meadow and not overwidened. Quantitatively, it should have an entrenchment ratio of >2.2 (Rosgen 1996). Favorable Rosgen channel types for meadows streams with floodplain connection are "C" and "E." These channel types have moderate to low width-to-depth ratios and moderate to high entrenchment ratios.

Once the stream has been evaluated, assign a rating by estimating the percentage of the stream length that has an entrenchment ratio of >2.2.

Water Table Alteration

Importance

The upper level of the saturated water zone in a meadow, or the "water table," is a critical factor for meadow condition. A high water table indicates optimum storage of subsurface water, slow water release during the dry season and the ability to produce a healthy meadow plant community. A lowered water table is often associated with a degraded channel (i.e., incised and/or widened) and adverse effects on plant communities on the meadow surface and streambanks.

Objective of This measurement

The objective is to determine the level of the water table in the meadow.

How Many Measurements to Take

Take one measurement per stream segment evaluated. This may be the entire meadow length, or subdivisions based on changes in channel configuration.

Where to Take the Measurement

Continually observe the level of the water table while assessing the meadow.

How to Take the Measurement

The water table level can be determined by first observing the channel form, then the floodplain connectivity. If channel form is normal (such as a "C" or "E" channel type), it likely has floodplain connectivity. In this case it is also likely that the water table level is not impaired (lowered), at least to the point that it may begin to adversely affect the plant communities on the meadow surface. If these conditions are met, record "3" on the data form.

If there are indicators that the water table level has been lowered, determine the depth to which that has occurred. This can be done by finding evidence of soil mottling below the surface of the meadow. Mottling may be observed either by coring or digging into the meadow surface, or by inspecting exposed streambank areas. The upper level of soil mottling indicates the natural or "reference" water table level, and the distance between this and the existing saturated level below is the amount of alteration in the water table. The critical level of drop is generally greater than about 0.5 m, since that is often associated with a change in plant community from deep-rooted sod forming herbaceous plant to plants that can exist in drier soils (Weixelman 2006). Record the appropriate class on the data form.

Streambank Stability

Importance:

Channel stability is an important indicator of the bank's susceptibility to erosion. Erosion may cause channel morphology alteration and excessive sediment deposition, which in turn affects aquatic habitat and fluvial processes.

Objective of the Measurement:

The objective is to characterize the stability of streambanks along the channel.

How Many Measurements to take

Take one measurement for the meadow.

Where to take the Measurement:

Observe the full length of the streambanks on both sides of the channel while walking the length of the meadow (or subdivided stream segment). Streambanks are the slopes immediately adjacent to the channel bed and extend upward to the crest of the first convex slope above bankfull stage or twice maximum bankfull depth, whichever occurs first.

Streambank stability is a measure of cover that protects streambanks against erosion. This cover consists of vegetation, rock, down wood or similar erosion resistant material. Cover most commonly occurs above the bankfull stage along streams. However, vegetative cover may extend below this level.

How to Take the Measurement:

After observing the streambanks throughout the meadow, rate streambank stability by placing the amount of stabilizing streambank cover into a quartile class. This includes combining the stabilizing cover on the banks on both sides of the stream. To do so, first decide if streambank stability over the distance assessed is more or less than 50%. If stability is more than 50%, divide that in half to determine the quartile class (e.g., 50-75%, >75%). Record the applicable score on the data form.

Stabilizing cover components include:

Live Plants – (1) Perennial herbaceous species, such as grass-sedge-rush; (2) woody shrubs (willows, etc); (3) broadleaf trees (cottonwood, aspen, alder, etc.); (4) conifer trees, and (5) plant roots that are on or near the surface of the streambank and provide substantial binding strength to the substrate beneath.

Litter/duff – Litter and/or duff at least 1" deep may count as cover if it is firmly affixed to the soil on streambanks. Litter consists of leaves, conifer needles and small twigs on the forest floor. As this material decomposes it becomes known as duff beneath the surface of newly accumulated litter. The combination of litter and duff can be an effective ground cover.

Rock – Boulders (>256mm), bedrock and cobble/boulder aggregates when combined as a stabilizing mass.

Down Wood – Logs that are firmly embedded into stream banks.

Herbaceous Plant Community

Importance:

Herbaceous plants usually provide the vast majority of vegetative cover in a meadow. This cover type provides a variety of services such as wildlife habitat, forage for livestock, aesthetics and soil health. The latter is best served when plant roots occupy the available soil profile or "A" horizon. This allows nutrient cycling that maintains or enhances long term sustainability of surface and subsurface organic material as well as an infiltration capacity that readily absorbs precipitation to minimize surface runoff and control erosion. The condition of the herbaceous plant community in a meadow is a key indicator of its soil health.

Objective of the Measurement:

The objective is to determine if the predominant herbaceous plant community is deep rooted plants associated with hydric soil conditions.

How Many Measurements to Take

Take one measurement for the meadow

Where to take the Measurement:

Take the measurement over the entire surface area of the meadow

How to Take the Measurement:

Walk the entire meadow from top to bottom and side to side. Observe all deep rooted plant communities that are commensurate with the potential natural community for the meadow type. Do so by observing "reference" plant communities at the lowest surface levels in the meadow, usually near the stream or in depressions. In meadows without a lowered water table these plants often occupy much of the meadow. In meadows that have a lowered water table they will usually exist to some lesser extent depending on the magnitude of the drop in the water table. In meadows with a lowered water table the location of the deep rooted plants may range from numerous scattered patches across the meadow to fewer but larger occurrences.

Once the meadow has been walked make an estimate of whether the deep rooted community occupies more or less than 50% of the surface area. If more than 50%, refine the estimate to determine if it is between 50-75% or more than 75%. Record the appropriate score for the percentage class on the data form.

If it is difficult to estimate surface area by ground view it may be helpful in estimating the percentage class by carrying a plan view of the meadow such as an air photo, ortho photo or satellite image.

Additional Attributes

Other attributes may be added to this assessment. However, recall that this a rapid assessment and that additions can slow the procedure.

Refer to the SCI or SSI Technical Guides for other candidate attributes and protocols, or utilize other protocols. Other attributes that may be considered include streambank disturbance (i.e., trampling and chiseling), aquatic fauna, streambed sediment, riparian vegetation.

Other Aspects of this Assessment

Quality Assurance and Quality Control

The quality of the assessment depends largely on well trained assessors. While there is no formal training protocol for this rapid assessment, study of the attributes and learning from persons experienced in the procedure via field training is essential for meaningful results.

Safety

Safety is the most important aspect of this procedure. Having a current Job Hazard Analysis, proper clothing and field equipment is essential in carrying out the task. Periodic safety meetings while working in the field help assure that the assessment is conducted safely.

References

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USDI Bureau of Land Management. 1998. A User Guide to Assessing Proper Functioning Condition and the Supporting Sciences for Lotic Areas. Technical Reference 1737-15. Denver, CO.

Weixelman, D. 2006. Personal Communication with David Weixelman, Regional Range Ecologist, Pacific Southwest Region, Forest Service. Vallejo, CA. July 2006.

Appendix: Data Forms (Version 2 December 2010)

See data forms on next two pages.

Form 1: Single Meadow – Sheet used for recording data on individual meadows, including space for notes and sketches.

Form 2: Multiple Meadow – Summary sheet used for recording scores and condition ratings of multiple meadows (does not have space for notes/sketches of individual meadows).

Meadow Hydrologic Function Rapid Assessment
Stanislaus National Forest

Meadow Name:	**Meadow Coordinates:** **UTME:** **UTMN:**
HUC Name (7th Level):	
Other Location Info:	
Observer(s):	**Date(s):**

Assessment Attributes					Summary	
Channel Form	**Floodplain Connectivity**	**Water Table Alteration**	**Streambank Stability**	**Herbaceous Plant Community**	**Score**	**Condition Rating**

Attribute Rating

Channel Form (CF)

3 - >75% of the stream length is Channel Form Class 1
2 – 50-75% of the stream length is Channel Form Class 1
1 - <50% of the stream length Channel Form Class 1

Floodplain Connectivity (FC)

3 - >75% of the stream length has an entrenchment ratio >2.2
2 – 50-75% of the stream length has an entrenchment ratio > 2.2
1 - <50% of the stream length has an entrenchment ratio > 2.2

Water Table Alteration (WT)

3 - >75% of the stream length has water table lowered < .25m
2 - >75% of the stream length has water table lowered .25-.5m
1 - >75% of the stream length has water table lowered >.5m

Streambank Stability (SB)

3 - >75% of the stream length is has stable banks
2 – 50-75% of the stream length has stable banks
1 - < 50% of the stream length has stable banks

Herbaceous Plant Community (PC)

3 - >75% of meadow has a deep rooted hydric soil associated plant community
2 – 50-75% of meadow is has a deep rooted hydric soil associated plant community
1 - <50% of meadow has a deep rooted hydric soil associated plant community

Condition Rating

Desired Condition (DC) = 14-15, **Good (G)** = 12-13, **Fair (F)** = 9-11
Poor (P) = 6-8, **Very Poor** (**VP)** = 5

Notes and Sketch (continue on reverse or extra page if needed):

Form 1 V2.0 12/2010

Meadow Hydrologic Function Rapid Assessment
Stanislaus National Forest
Summary Sheet

Location: _____

Date(s):_____

Meadow Name	Assessment Attributes					Summary	
	CF	FC	WT	SB	PC	Score	Condition Rating

Attribute Rating

Channel Form (CF)

3 - >75% of the stream length is Channel Form Class 1
2 – 50-75% of the stream length is Channel Form Class 1
1 - <50% of the stream length Channel Form Class 1

Floodplain Connectivity (FC)

3 - >75% of the stream length has an entrenchment ratio >2.2
2 – 50-75% of the stream length has an entrenchment ratio > 2.2
1 - <50% of the stream length has an entrenchment ratio > 2.2

Water Table Alteration (WT)

3 - >75% of the stream length has water table lowered < .25m
2 - >75% of the stream length has water table lowered .25-.5m
1 - >75% of the stream length has water table lowered >.5m

Streambank Stability (SB)

3 - >75% of the stream length is has stable banks
2 – 50-75% of the stream length has stable banks
1 - < 50% of the stream length has stable banks

Herbaceous Plant Community (PC)

3 - >75% of meadow has a deep rooted hydric soil associated plant community
2 – 50-75% of meadow is has a deep rooted hydric soil associated plant community
1 - <50% of meadow has a deep rooted hydric soil associated plant community

Condition Rating

Desired Condition (DC) = 14-15, **Good (G)** = 12-13, **Fair (F)** = 9-11
Poor (P) = 6-8, **Very Poor** (**VP)** = 5

Form 2 V2.0 12/2010

Motorized Road and Trail Condition Inventory

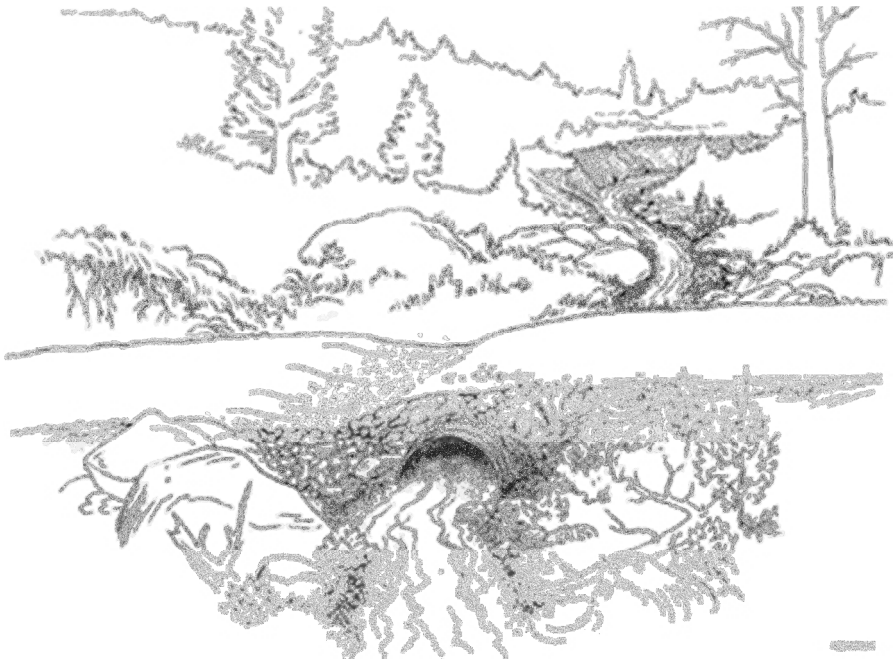
Stanislaus National Forest

August 2011

United States
Department of
Agriculture

Forest Service

Version 3.1



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Preface

Version 3.1 Update

Version 3.1 updates the third revision of the Stanislaus Motorized Road and Trail Condition Inventory, clarifying the general road condition protocol. Version 1.0, the Clavey River Watershed Analysis-Road Inventory HCS (2006), was developed to complete a rapid inventory of roads in the Clavey Watershed. Version 2.0, the Stanislaus Motorized Road and Trail Condition Inventory-Hydrologically Connected Segments HCS (2009), was developed to broaden the inventory to motorized roads and trails at the forest-wide scale. In addition, minor protocol and data form revisions were made. Version 3.0 (2010) was developed to include not only HCS inventories but also general road condition and culvert inventories as well. This includes protocol and form revisions to capture the additional attribute information to be collected. In addition, a glossary of terms has been added. An ArcMap geodatabase has been created for this protocol to be used with ArcPad Mobile GIS.

Acknowledgements

Special thanks and recognition are extended to those who have contributed extensively to the content of this protocol:

The initial Road Condition Inventory development team (Versions 1.0 and 2.0), for research, writing, field-testing and analysis: Jim Frazier and Sharon Grant;
The Version 3.0 Road Condition Inventory revision team, for developing and troubleshooting the extensive use of GPS/GIS, updating attributes and improving protocols and field procedures: Tom Durston, Foster Kuramata, Carly Gibson, initial team members, and the 2010 field crew (James Donnelly, Sunny Grunloh, Robert Ingles, Katherine Kellogg-Campbell, Megan Layhee, Michael Maschi, Lisa McConnell, Alan Neff).

Suggested Citation

Grant, S.L., T. Durston, J.W. Frazier, F. Kuramata, August 2011. Motorized Road and Trail Condition Inventory, Version 3.1. USDA Forest Service, Stanislaus National Forest, Resource Management Program Area. Sonora, CA, 44 pp.

Introduction

The following protocols guide the collection of data to determine condition of forest roads. For simplicity, the terms road and roads are inclusive to motorized trails since trails, though minor in scope to roads, can also be inventoried using this document.

Road condition is vital information to protect and manage transportation infrastructure and natural resources, and provide for user safety. Road conditions in this document are addressed in Hydrologically Connected Segments (HCS) and general road conditions. Hydrologically connected segments are those portions of roads that increase the drainage network within a watershed and deliver additional water and sediment to stream courses. General road conditions that do not increase the drainage network or directly increase sedimentation in stream courses may affect the environment and infrastructure through erosion of road surfaces, cut and fill slopes, and mass wasting. The consequences can be stream sedimentation above a desired level, either from direct input of sediment or an increase in flow that may cause stream channel erosion. This inventory collects information about road location, use, surface type, drainage structures, and features such as gates, cattle guards and recreation sites to help in management of the transportation system.

Methodology

The Motorized Road and Trail Condition Inventory is a field extensive methodology for evaluating the existing condition of roads. It is an integrated hydrologically connected road and general road survey at the watershed level. This inventory is applicable at multiple spatial scales, from projects to watershed analysis. The road condition inventory can identify candidate roads for maintenance, and roads that require a more intensive survey for reconstruction and decommissioning. It can also provide information for transportation and travel management planning.

As an extensive inventory, it is intended to gather information to characterize existing road conditions over large areas in a time-efficient manner. As such, data collection methods include both quantitative measurements and non-quantifiable observations. Training is provided for both to obtain consistency between observers and over time.

The road condition inventory is designed to be conducted on the National Forest Transportation System (NFTS) and unauthorized roads.

This inventory will be conducted by driving or walking applicable routes, identifying HCS sites and condition, and recording appropriate data.

Objectives

The objectives of the inventory are to:

Determine HCS locations to help develop road or trail projects that will protect or enhance water quality.

Determine road prism and culvert condition to assist the development of road maintenance, reconstruction and decommissioning projects for resource and transportation infrastructure protection, and for user safety.

Record observable indications of access need to develop information for travel management decisions.

Focus of the Inventory

The focus of the inventory is all primitive, native and aggregate surface motorized roads, stream crossings and cross drains, and along near-stream road segments (within about 300 feet from a stream). This can include non-drivable, decommissioned, unnamed, and closed roads that are encountered along the drivable roads. Paved roads are generally not included in the HCS inventory since they usually result in less stream sedimentation than native or aggregate surface roads. However, large hydrologically connected segments on paved roads can be identified where applicable. Paved roads may be included for road condition and culvert maintenance inventories.

The end use of the road condition and HCS inventory will be potential projects to protect or enhance water quality, and to protect the road investment and public safety. These projects will include maintenance and reconstruction of needed roads, and decommissioning of unneeded roads. It also may include relocation of needed road segments to minimize or eliminate hydrologic connectivity, and decommissioning the no longer needed portion of the road. It may be used in determining which routes should be included in the designated transportation system

Road Condition Inventory Protocols

The protocols, or procedures, for inventorying roads and recording field data are described below. Base data is downloaded into a mobile Global Positioning System (GPS) unit and field data is recorded using a geodatabase and/or hardcopy forms. The field data is uploaded into a compatible geographic information system (GIS). GIS allows users to view and interpret on the ground spatial (mapped point, and line features) and tabular attribute (character description) data in many ways that reveal relationships, patterns, and trends. This inventory uses ArcMap/ArcPad GIS for spatial and attribute documentation.

The geodatabase includes six feature classes. The feature classes are line and point layers for storing spatial and tabular data. Each data collection feature class has five common data items (fields): Road Identification (RoadID), Photo Identification (PhotoID), Comments, Date Inventoried (Date_Inv), and Observer. Table 1 provides a brief description of each feature class. Feature class items are described in detail along with the collection and recording procedures in the following sections of this protocol.

Table 1. Feature Class Description

Feature Class	Type	Description
Road Streaming	Line	This feature class is for recording basic road information such as location, use and surface material. It contains eight unique fields (e.g., surface type, current type of vehicle use, and traffic volume).
Road Risk Line	Line	This feature class is for recording data related to environmental impact or safety risk. It contains eight unique fields that identify road erosion conditions (e.g., gully erosion; landslides, washouts and steep grades) along road segments that are not hydrologically connected. This feature class is used for recording locations > 200 ft. in length.
Road Risk Point	Point	This feature class records the same type of information as the Road Risk line feature class. It should be used for smaller sites (< 200 ft. in length).
Hydrologically Connected Segments (HCS)	Point	This feature class is for recording Hydrologically Connected Segment (HCS) data. It contains twelve unique fields that identify HCS erosion conditions (e.g., rill and gully erosion, diversion potential and % grade) on near-stream segments and at stream crossings. HCS data collected will be recorded for the right bank (RB), left bank (LB) and near-stream (NS) separately.
Drain Structures	Point	This feature class is for recording all cross drain culverts and stream crossing structures (i.e., culverts, bridges and fords). It contains nine unique fields for documenting stream crossing and cross drain structure characteristics and conditions (e.g., size, function, flow regime).
Road Points	Point	This feature class is for infrastructure and access related point features (e.g., gates, barriers, cattle guards, and dispersed campsites,). The road points feature class also includes terminus points used at the beginning and end of roads, road sections and road segments for HCS, Road Streaming and Road Risk features classes.
Assignment Layer	Line	The assignment layer is the existing road data used for this inventory. The record of each road assigned includes several of the most relevant attributes from the existing NFTS Infra data. In addition, fields for the name of the crew assigned to perform the inventory, and report accomplishment of the inventory are included.

When recording data into the mobile GPS unit or on the worksheets, follow all naming conventions where specified or select from the field list options or drop downs when available. The mobile GPS database field order may differ from the forms for ease of documenting data in the field.

In addition to the six feature classes of information to be collected, the geodatabase includes an assignment layer or feature class, which shows the roads assigned to be inventoried. This feature class can be viewed for landmark information, queried for existing inventory information, and can be edited to show completion of reconnaissance on an assigned road.

Process for Collecting Data

Data is collected by driving forest roads and recording the information required in this protocol. There may be roads that are not drivable, in which case they will have to be walked to collect the information.

Table 2 defines road terms used in this inventory and the subdivisions of roads for partitioning data as the inventory is conducted.

Table 2. Roads and Road Subdivisions

Road Term	Definition
Road	A road is the entire length of a numbered motorized travel way. For example, road 2N11 is about 14 miles long between roads 1N01 and 1N04.
Section	A section is the longest subdivision of a road with homogeneous characteristics. For example, a road may have 4 or 5 sections ranging from 2-3 miles long, divided by changes in surface type and design vehicle.
HCS Segment	HCS segments are identified as subsets of sections where the road is hydrologically connected.
Risk Features	Risk features are identified as subsets of the general road condition where environmental impact or safety risks greater than normally accepted on forest roads are found. Risk features are not inventoried within HCS segments because the HCS methodology records needed risk information.
SOR	Start of Road
EOR	End of Road
BOL	Beginning of Log
EOL	End of Log
Undriveable	Road prism continues but is not driveable in a standard vehicle (e.g., SUV, pick-up, 4x4).

Three driving passes along the road are required to collect all the data for each section of road—two data collection passes and one quality assurance (QA) pass (for data check purposes). Completion of Pass 3 represents the beginning of a new road section or the end of the road (EOR).

Pass 1: Road Streaming Inventory/End of HCS (flagging)/Reconnaissance

Pass 1 is conducted by collecting and recording the Road Streaming linear data and carefully observing for all hydrologically connected segments (HCS) and risk features within the section. At the beginning of the road, record a uniquely labeled terminus point in the Road Points feature class. This will accurately locate the beginning point for GIS processing. Flag the end of each HCS and each risk feature encountered. HCS segments have two end-points—in this case; the end refers to the far end of the HCS as the section is driven. Road risks may be a linear or point feature depending on size; flag the end for linear and the center for point features. Flagging the HCS segments and risk features in this first pass is critical for data collection in the second pass.

During Pass 1, also observe the road in general for surface type, design vehicle, erosion, drainage features, uses, steep grades and road points such as gates or cattle guards. At the end of Pass 1, flag the end of the section as a reference location for starting the next section and record another uniquely labeled terminus point feature in the Road Points feature class. The terminus point feature will include attribute information on what type of route, if any, lies beyond the terminus.

Pass 2: Road Erosion, Drain Structures, Road Points and Road Risks

On Pass 2 of the section (driving in the opposite direction of Pass 1) collect all the point feature class data—HCS, Drain Structures, Road Points, and Road Risk Points—and the Road Risk line feature class data. The section will be divided into HCSs and general road condition. Within each general road condition collect and record all drain structures, road points and road risk features.

To begin Pass 2, drive or walk to the beginning of the first HCS. The flagging set during Pass 1 will now represent the start for each HCS on this pass. HCSs will be identified by right bank (RB-HCS), left bank (LB-HCS) and mid-point (MP-HCS) and recorded in the HCS feature class.

When the HCS flag is encountered, walk to the other end of the HCS; identify the end location by making a foot scuff on the road surface. Collect the HCS (RB, LB, MP or NS), Drain

Structure and Road Points data by documenting on the HCS worksheets. Mark the required GPS points in the appropriate feature classes (HCS, drain structure and road points) and record the data. These points will include RB-HCS, LB-HCS, MP-HCS, Drain Structure(s), Single Erosion Points, and Road Points if encountered within the HCS. Pull the flagging that identified the HCS and/or roads risks.

If Pass 2 does not begin with an HCS, drive and collect all required data for general road condition (Road Risk line, Road Risk Point, Drain Structure and Road Point) until encountering the first HCS flag location. Mark and record data for Drain Structures, Road Risks and Road Point features when they are encountered along the way.

Pass 3: Quality Assurance (QA)

On Pass 3, returning to the end of the section, identify any inventory items that may have been overlooked or forgotten, such as a steep grade or gate location. Before starting Pass 3, always check data collected in Passes 1 and 2 for anything missing, include reviewing data in the GPS making sure it looks reasonable. Pull any remaining flagging.

Data Items Common to each Feature Class

There are five common data items or fields included in each of the five feature classes. The fields are defined in the following table. Follow all naming conventions where specified or select from the field list options or drop down menus when available.

Table 3. Common Data Fields to each Feature Class

Data Field	Description
Route ID	Route Identification Number: enter the Route ID Number from the map (e.g., 03N01, 2S04YA, FR8323. 15EV59). Routes not documented on existing maps or in GIS—need to be identified with a unique route identifier, 3 initials + date (mmddyy) + 24-hour time (hhmm), for example, initials slg + JUN 6, 2010 + 08:52 would look like this slg0604100852. The 24-hour time stamp is very important to give each Route ID a unique identifier.
Photo ID	Take photos of notable items, damage, and large erosion features. Input the photo number (last 4 digits) after "IMGP" + the camera alpha identifier (no spaces); followed with an underscore and the route number (e.g., IMGP0014A_1N03, IMGP0006A_slg0511100852).
Comments	Document any significant or required comments—pertaining to the feature item, you are collecting—in this field.
Date Inv	Date Inventoried: enter the date data was collected in this field using the following format: mm/dd/yyyy
Observer	Enter the observer recording data into the GPS unit or documenting on the forms (first initial, period, last name, such as S. Bear or W. Owl)

The Assignment Layer

The project leader will create an assignment layer in the geodatabase showing which roads are to be inventoried. For the 2011 Stanislaus Road Inventory Phase II, within the planning area, all known roads except those on other jurisdiction (i.e., Private, BLM, BIA, State and County) will be assigned. Roads—other than decommissioned, not in use or not located—that are undriveable will be inventoried on foot. Do not GPS roads that are less than 200 ft long, unless the road provides access to a dispersed campsite.

The roads in the assignment layer that are listed as decommissioned in the "MGT" field should be located and identified as decommissioned or still in use. A decommissioned road will be blocked with no signs of use. In this case, select "DECOM" in the Recon_Assigned field. When a decommissioned route is located and in use, an entire inventory is required.

Roads that are assigned but visibly not in use—completely overgrown with trees and shrubs and have no visible use—record "Not in Use" in the Recon_Assign field. These roads will appear similar to a decommissioned road and are undriveable.

When an assigned road cannot be found on the ground (no road prism visible)—returned to natural conditions or was miss-mapped—record "Not Located" in the Recon_Assign field.

Roads that are located on the ground but not on the existing map or in the GIS roads layer will be inventoried and given a unique route inventory ID (see Table 3, Route ID for naming convention). This data will be added to the existing road inventory.

Objective of this Measurement

The assignment layer identifies which roads are to be inventoried and tracks accomplishments.

Where to Take the Measurement

Update the assignment layer with accomplishment information when the inventory for each road is complete.

How to Take the Measurement

Update the Recon_Assign, Recon_Date and the Observer fields of the assignment layer when inventory is completed on a road.

In the Recon_Assign field, the name of the assigned crew is replaced by the type of accomplishment or road condition observed. See Table 4 for field value and description.

Table 4. Recon Assignment Field Values

Field Value	Description
Team1 or Team 2	The initial entry created during the setup of the inventory is the name of the crew assigned to inventory the road.
Done	The assigned route was observed and data was recorded.
Not Assigned	Roads that are not assigned for inventory based on jurisdiction/ownership, or project objectives.
Not Located	Site visited - road was not located on the ground (no road prism visible). This may indicate the route has returned to natural conditions or that the route was miss-mapped in the GIS.
Not in Use	Site visited - road prism was located but not in use. Road is completely overgrown with trees and shrubs, returned to natural condition. Road may appear the same as decommissioned roads on the ground. Road not surveyed.
Decom	Site visited - noted that the existing inventory status is Decommissioned, and confirmed that the route has been physically decommissioned and not in use. Road not surveyed.
Non-Motorized	Route is a non-motorized trail (not surveyed).
Own Other	Road is other ownership (i.e., PVT, BLM, BIA, State, County). Road not surveyed.
Other	Note in comments (e.g., road is blocked by private land, no access, not surveyed).

Road Streaming Feature Class

The Road Streaming feature class is for documenting the alignment and attribute data of assigned roads. The attribute table is used for collecting basic infrastructure data on the road. Data collected in the field will be compared against the current Stanislaus National Forest road inventory spatial data and corrections will be made.

The following figure and table describes the components of a road (road template) used for this inventory.

Figure 1. Road Template

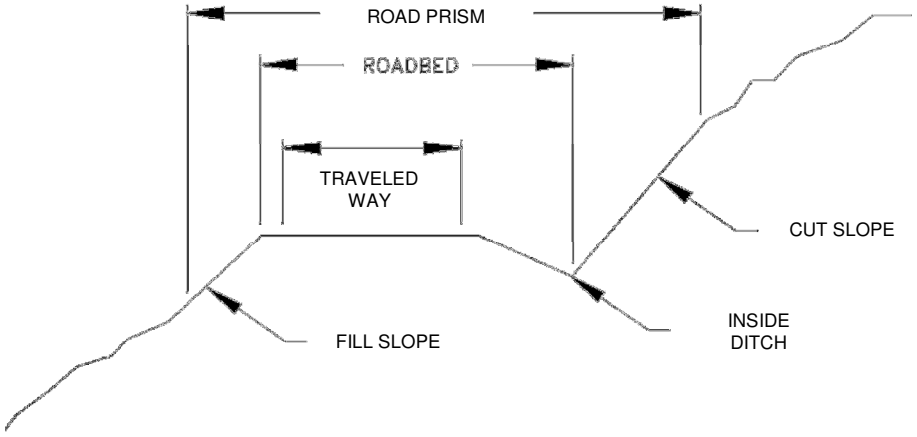

Table 5. Road Template Description

Component	Description
Road Prism	The road prism is composed of the traveled way, the cut slope, and the fill slope. It includes features like the ditch. It is the section of the hillslope, flat, ridge, etc. that has been directly affected by the construction of the road
Roadbed	The roadbed includes an inside ditch (if present), traveled way and the shoulders.
Traveled Way	The traveled way is the driving surface area of the road.
Fill slope	The fill slope is the steep slope on the downhill side of a road, which is the result of the embankment of material, often from the cut slope, to make a flat surface for the road
Cut slope	The cut slope is the steep bank above a road, which is the result of the excavation to make a flat surface for the road.
Inside Ditch	On road segments designed as insloped where drainage is concentrated in a ditch between the road surface and the cut slope, drainage is carried away from the road in cross drain culverts at designed intervals.

Unique Point ID

Objective of this Measurement

These unique points facilitate accurate GIS representation of the line feature and indicate what type of route, if any extends beyond the ends of that line feature.

Where to Take the Measurement

Mark the beginning and end of each road, road section, or road log point in the road point feature class.

How to Take the Measurement

This point will be collected in the road points feature class but also documented in this feature class for GIS cross reference purposes.

The terminus point ID discussion in the road point feature class section describes how to document these points.

Road Surface Type

Objective of this Measurement

Determine the surface material on the traveled way.

Where to Take the Measurement

Along all roads designated for inventory.

How to Take the Measurement

Surface material may be the same for an entire road, or may change along the road. Most roads on the Stanislaus National Forest are native surface. Begin a new Road Streaming line feature where the surface type changes, unless the change in surface type is for a very short distance, generally less than 250 ft. If a native surface road has many short segments of surfacing, call the whole road "Improved". See Table 7 for definitions of road surface type.

The surface type is usually visible as you drive. If in doubt, take a shovel, dig a small hole in the side of the road through the surface to the subgrade (soil) below, and observe the depth of surfacing material.

Table 7. Road Surface Types

Surface Type	Definition
Native	Native surface roads are those that have been constructed by mechanical road building equipment—and have no improved surfaces (e.g., aggregate, chip seal)—as opposed to primitive surfaced roads (see Primitive below).
Aggregate	Aggregate (crushed rock) - the aggregate surface material will be composed mostly of fractured stone from ¼ inch to 1½ inches in diameter. It can be difficult to distinguish aggregate from native soil. Dig a hole through the top few inches of the surface with a shovel if in doubt. The aggregate surface will usually—but not always—be a different color from that of the native soil in the cut bank.
Asphalt	Asphalt concrete (asphalt) - To distinguish asphalt from chip seal, look at the depth. Asphalt concrete is generally about 2" thick or greater.
Chip Seal	Similar to asphalt but 3/4" or less thick. If less than 50% coverage show as Aggregate
Improved	Mostly native but with improved surface like aggregate in places
Primitive	Primitive surface refers to user created roads or wheel tracks. These surfaces are native soil, have never been flattened or smoothed by mechanical road building equipment and will not have cut or fill slopes.

Design Vehicle

Objective of this Measurement

Determine the largest or most limiting vehicle that could drive the road as it was originally constructed.

Where to Take the Measurement

At each road section.

How to Take the Measurement

In most cases, the design vehicle will be evident. If the design vehicle is not clearly understood, take measurements. If there is no apparent evidence clearly indicating the design vehicle type, leave this field blank and make a brief note in the Comments field. If measurements are needed, measure the geometric standard of the road in feet—width, grade

and curve radius. Visualize how the road would look after removing encroaching vegetation and repairing erosion and other road damage.

Width Measurement

For width measurement, look for the original road edges (shoulders), which may be covered with heavy brush, logs, or even soil displaced by erosion. The road template usually has a level portion of traveled way and a cut slope above one shoulder and a fill slope below the shoulder. Some sections may have a cut on both sides or a fill on both sides and some may daylight onto flat ground. The shoulder on the fill side may have a berm. Measure as if the berm were removed. The shoulder on the cut side may be buried with soil that has sloughed down. Measure as if the slough material were removed.

Grade Measurement

For grade measurement, look for the steepest grade of the road section. A road may have significant portions with gentle grades suitable for all vehicles, but may include scattered steep segments suitable only for four wheel drive vehicles and ATVs. The concern over steep grades is related to traction. Trucks usually lose traction on grades steeper than 16%, depending on the type and condition of the surface. Chip vans lose traction on slightly gentler grades.

Some very short steep segments, generally under 100 ft, may be negligible because a truck can pass over them using momentum, but momentum cannot be used on sharp curves. Therefore, if the steep grade is less than 100 ft and it appears that a truck could pass over it using momentum, ignore the short steep section in determining the Design Vehicle.

To measure grade, use a clinometer and sight ahead on a target at your eye level. The target can be a point on your vehicle, a flag you have hung at eye level, a point at eye level on another crewmember, or a point on a natural feature like a tree, rock or bush that you can see is approximately the height of your eye. When sighting on a natural feature, crouching as low as possible will improve the accuracy of estimating eye height on the feature.

Curve Radius Measurement

Estimate the curve radius by visualizing the center of the curve and measuring the radius from that point to several points along the center of the traveled way, using a rangefinder, or by pacing, or measuring tape.

Once the above geometric standard measurements are collected, select the appropriate drop down choice in the design vehicle domain.

Table 8 lists the design vehicle options with the most restrictive on the top (except Railroad). Select the most restrictive vehicle, which could use the road as originally constructed. Select railroad if it is evident that the road originated as a railroad grade.

Table 8. Design Vehicle Definitions

Design Vehicle	Definition
Log Truck	Log truck geometric standards: road width at least 12' wide, grade < 17%, curve radius at least 50 feet.
Pickup	2WD pickup geometric standards: road width at least 8' wide, grade < 17%, curve radius at least 30 feet.
4WD	4WD geometric standards: (full width short wheelbase 4WD pickup or SUV) road width at least 8' wide, curve radius at least 30 feet. Can have steep grade > 17%, and rough rocky terrain not suitable for 2WD.
Skidder	Originated as skid trail: may currently be used as an ATV trail or 4WD road, but shows evidence of original use as skid trail because it begins at a landing on a log truck road and goes into an area where trees have been harvested. Only use this category if skid trail design evidence is apparent.
Railroad	Originated as a logging railroad: may currently be used as a log truck or other type of road. Only use this category if evidence of railroad grade is apparent. Unique characteristics of logging railroads are very low gradients (< 3%), tight curves, passing through ridges where there are through-cuts. Railroad artifacts such as ties or pieces of rail on or next to the road may be present.

Current Vehicle

Objective of this Measurement

Determine the largest or most limiting vehicle that could drive the road in its current condition.

Where to Take the Measurement

Determine the Current Vehicle for each road section.

How to Take the Measurement

The Current Vehicle is the most limiting vehicle for which use is appropriate in the road's current condition. Take into account the roughness of the surface, the vegetation at road edge or in the road, and obstacles. Show the type of vehicle, which a reasonable person would say is appropriate on this road in its current condition.

For example, when determining whether "Car-slow" is the appropriate category consider if it is reasonable to expect that a low clearance 2-wheel drive passenger car could drive this road, or if the road is drivable only by a high clearance vehicle such as a large truck or 4WD.

The current vehicle categories, in descending order of most to least restrictive, are listed below. Select the most restrictive vehicle for which use is currently appropriate.

Table 9. Current Vehicle Definitions

Current Vehicle	Definition
Car-fast	The road has a smooth surface (paved or chip seal), drivable at > 25 mph in a standard 2WD car. Traveled way and shoulders are clear of encroaching vegetation allowing for good sight distance at a moderate rate of speed. Road is comfortable and safe for car traffic.
Car-slow	The road surface has a smooth well-graded aggregate surface and is drivable < 25 mph in standard 2WD car. Traveled way is clear of encroaching vegetation and obstacles.
Log Truck	The road surface is smooth enough for a large truck to drive at low speeds (5 – 10 mph), the traveled way is clear of encroaching vegetation and obstacles at least 12 feet wide.
Pickup	The road surface is smooth enough for a 2WD pickup to drive at low speeds (5 – 10 mph), the traveled way is clear of encroaching vegetation and obstacles at least 6-8 feet wide.
4WD	The road may be rough and rocky with obstacles (such as boulders) and can have steep grades (> 17 %), can be driven at low speeds in a full width short wheelbase 4WD pickup or SUV. The traveled way is clear of encroaching vegetation and obstacles at least 6-8 feet wide.
ATV	The road surface can be smooth or may be rough and rocky with obstacles (such as boulders) and can have steep grades (> 17 %). The traveled way is clear of encroaching vegetation at least 50", allowing travel for ATVs (quads).
Motorcycle	Single-track wheel path indicates the only motor vehicles using the route are motorcycles.
Blocked	The road is closed to motor vehicle traffic by a man-made barrier (e.g., earthen berm, boulders or fence).
Undriveable	The road is closed to motor vehicle traffic by a natural barrier (e.g., brush, downed trees or road surface washout).

Traffic Volume

Objective of this Measurement

Estimate the traffic volume for each road section.

Where to Take the Measurement

Determine the Traffic Volume while driving or walking the road.

How to Take the Measurement

Observe the condition of the road using field indicators, such as surface and vegetation to identify current traffic volume. The following table describes volume and field indicators.

Table 10. Traffic Volume Field Indicators

Traffic Volume	Field Indicators
Frequent	Frequent: road used regularly—road surface is free of vegetation or other obstacles.
Infrequent	Infrequent: road used infrequently—grass or low brush in traveled way; however, wheel tracks are evident.
None	None: no motor vehicle traffic—traveled way is revegetated or covered with duff layer; there is no evidence of wheel tracks.

Observed Use (optional)

Objective of this Measurement

Determine the type of access for which the road is currently used to help determine the level of need and whether the road should be on the transportation system.

Where to Take the Measurement

Observe use indicators for each road section.

How to Take the Measurement

It is not expected that the field crew will be able to determine the purpose or use of every road, but if evidence is observed it should be entered in this optional field. If there is no clear evidence of for the type of use, leave this field blank. If more than, one use is observed select "Multi" for multiple uses. Multiple uses are common for major forest roads accommodating such uses as logging, recreation and administrative travel. Minor roads may have only one use or may no longer have any use. Be observant of the uses for roads and input what you see. The allowable values for use are shown in the following table.

Table 11. Observed Road Uses

Road Use	Description
Admnsite	USFS administrative site, such as Ranger Station or heliport.
Boating	Boat ramp or put-in.
Canal	Canal, water transmission ditch or flume.
Commsite	Communications antenna site.
DisCampsite	Dispersed campsite: this applies to any undeveloped site where a campfire ring or other evidence of camping is present. *NOTE: GPS the campsite in the Road Points feature class.*
DevRec	Developed recreation site: This applies to Forest Service developed recreation sites, such as campsites or day use areas. They will have USFS signs and may include development, such as tables, toilet buildings or campfire grills.
Driving	Driving for pleasure: this applies if there is evidence that the road is popular for sight-seeing by passenger cars.
Fire	Initial attack or water drafting.
Logging	Logging use: this applies where there is evidence that the road has been used for logging. Look for landings at road edge or at the end of the road. Observe for stumps and young trees above the road.
Mine	Mine tunnel or shaft.
Multi	Multiple uses: more than one use or purpose.
NonMotor	Non-motorized use (hiking, equestrian): this applies when the road has no vehicle traffic but there is evidence of hiking or equestrian use.
OHV	Driving for pleasure, 4WD or ATV standard.
Other	If other use is observed, input the type in the Comments field.
Penstock	Hydropower pipe conducting water to generator.
Raft	Raft put-in.
Range	Stock fence, trough or salt station.
Rock	Rock or soil quarry.
Util	Utility access: power lines, phone tower or poles.
Water draft	Water drafting site,
Redundant	Another road provides better access: applies if it is clear that another road provides equal or superior access and is better in terms of access provided or environmental impacts.
Unneeded	Obviously not currently needed: applies to roads with no current use or senseless use such as spinning donuts in a meadow.

Road Risk Line Feature Class

Road Risk Line is the feature class for recording portions of road—outside of HCS—that have notable erosion, drainage, safety problems, or steep pitches. The road risk feature should distinguish the unusually problematic road segments from the bulk of the road system having normal expected environmental and safety risk. Erosion problems to be inventoried would be notable by the quantity of material eroded and potential for future erosion, which may need mitigation. As a rule of thumb, Road Risk features are no smaller than approximately 6 inches deep by 50 feet in length.

Since Road Risk features are intended for unusually problematic road segments, the total length of Road Risk features will probably not cover more than 25% of the length of roads inventoried.

Record risk features longer than approximately 200 feet in the Road Risk line feature class and risk features shorter than 200 ft in the Risk Points feature class.

Objective of this Measurement

The road risk information will identify road segments with environmental impact or safety risks notably greater than ordinarily encountered on forest roads. It is used to highlight portions of the road that may require special attention in travel management, road improvement or restoration decisions.

Where to Take the Measurement

Road Risk line features should be recorded on problem areas with a linear shape, outside of HCS segments.

Risk Feature

The common types of road risks, that may be found are erosion, unauthorized OHV activity (e.g., hill climbs), and notable drainage problems. Drainage problems such as a trough shaped road segment that funnels runoff down the road because the surrounding land is higher may be recorded as a road risk. Other drainage problem examples include roads crossing meadows and wet areas, and steep pitches. Potholes and mud holes can be recorded as Road Risk line segments if there is a relatively long area involved, or can be recorded in the Road Points point feature class if they are better mapped as a point.

The following table describes the risk values. If more than one type of risk is encountered at the site, enter the value most representative of the problem being noted.

Table 12. Road Risk Definitions

Field Value	Description
Berm	Road edge berm blocks drainage
Erosion Cut Bank	Erosion of cut bank
Erosion Fill Bank	Erosion of fill bank
Erosion Rd Surf	Erosion of road surface
Hill Climb	Unauthorized hill climb
Hillslope Gully	Gully on hillslope above or below road
Landslide	Landslide, debris flow, mass wasting
Meadow Xing	Road passes through meadow
Mudhole	Depression larger than approx 8' filled with water in spring
Pothole	Depression up to approx 6' diameter
Trough	Road is lower than surrounding land
Washout Partial	Washout eroding part of road
Washout Full	Individual circular or oval depressions in the road surface that are longer then they are wide. Length should be greater than 15 feet (some can be up to 50 feet in length).
Wet Area	Roadbed wet most of the year. Grassy road surface and rutting are indicators in dry season.

Erosion Rate and Dimensions

Erosion rate is an indicator of the overall stability of the erosion feature. The erosion rate and dimensions should be recorded for erosion of cut banks, fill banks, road surface, hillslope gullies, landslides and washouts. Record the erosion rate, width, depth and percent.

Erosion Rate

The Erosion rate should be recorded as stable or active, as in Table 13, where stable indicates that erosion has occurred but the current surface is hardened by stone or bedrock, and active indicates that erosion is continuing to displace soil.

Table 13. Erosion Rate

Erosion Rate	Field Indicators
Stable	Erosion stabilized, hardened by stone or bedrock not growing
Active	Erosion continuing to displace soil

Erosion Width and Depth and Percent

The width and depth of the eroded area should be measured in feet. Record width and depth dimensions representative of the feature being described. These dimensions may be the average width and depth.

For an area with intermittent erosion features like series of road surface gullies, the width and depth representative of the more serious parts of the line feature may be entered, and the erosion percent can be entered as the proportion of the line feature in which the representative width and depth are found. For example, if a 1,000-foot long Road Risk line feature were GPSd and 3 foot wide by 1-foot deep gullies occurred on about 50% of the line feature, the erosion width would be recorded as 3 feet, the erosion depth would be recorded as 1 foot, and the erosion percent would be recorded as 50.

Steep Grade

While driving the road, observe for portions of steep grade greater than 17 percent and approximately 200 feet or greater in length. Measure the grade using a clinometer and collect a risk line. Record the percent grade to the nearest whole number in the "Grade" field provided in the risk line feature class.

Attention

Use this field to note urgent need for attention if action is needed quickly to prevent increasing resource damage such as gullies, washouts or landslides, or if action is needed quickly to guard against vehicle accidents, such as placing barriers to guide vehicles away from undercut road edges or washouts (Table 14).

Table 14. Urgent Attention Needed

Attention	Definition
Urgent Safety	Urgent safety situation
Urgent Resource	Urgent resource impact situation

Road Risk Point Feature Class

Road Risk Point is the feature class for recording risk points—outside of HCS— that have notable erosion, drainage or safety problems. It is used to highlight portions of the road that may require special attention in travel management, road improvement or restoration decisions. This feature class is very similar to the Road Risk line feature class but can be used where point feature geometry is more appropriate than line feature geometry. As a rule of thumb, use the Risk Point feature class where the risk feature is shorter than 200 feet.

The fields for this feature class are the same as the road risk line feature class (risk feature, erosion rate/width/depth and grade) with the exception of erosion length and percent. The erosion feature dimensions are slightly different from the line feature class because the length must be entered in feet and the erosion percent of length entry is absent. All other guidelines from the road risk line feature class are the same.

Hydrologically Connected Segment (HCS) Feature Class

Hydrologically connected segments are those portions of roads that increase the drainage network within a watershed and deliver additional water and sediment to stream courses.

Hydrologic connectivity depends on factors such as distance and slope gradient between the roads and the stream and sediment filtering capability of the forest floor (see glossary).

Objective of this measurement

To determine potential projects to protect or enhance water quality, such as maintenance and reconstruction of needed roads, and decommissioning of unneeded roads. It also may include relocation of needed road segments to minimize or eliminate hydrologic connectivity, and decommissioning portions of the road.

Where to take this measurement

All stream crossings and near-stream sections of roads designated for inventory (within approximately 300 feet of a stream).

How to take this measurement

There are four HCS components: 1) road surface erosion, 2) cut and fill slope erosion 3) road gradient measurements, and 4) stream crossing fill dimensions.

HCS components 1-3 are collected and recorded on the right bank (RB) and left bank (LB) of stream crossings and at near-stream (NS) segments. Component four, Stream crossing fill dimensions, will be collected and recorded with the culvert data in the Drain Structure feature class.

Collect all applicable data on the HCS worksheets (see Appendix B). Once the HCS segment is inventoried and calculations are complete, record the data from the worksheet into the GPS unit. Complete one worksheet for each HCS.

Stream Crossings

To identify the right bank (RB) and left bank (RB) stand over the stream crossing facing downstream. The RB is on the right and the LB is on the left. The mid-point (MP) between the RB and LB is the stream crossing drain structure. Always mark a GPS point at the right bank, left bank and mid-point of the HCS. Document a unique ID for each point on the worksheet and record the data in the GPS.

When there are two or more drainages and/or culverts in one HCS record each separately in the Drain Structure feature class. Select the drainage with the lowest elevation and mark a MP-HCS. If all drainages and/or culverts are about the same elevation, mark the MP-HCS on the largest or dominant drainage.

Near-stream

A near-stream road segment runs close to a stream without crossing it, and delivers sediment to the channel. Most near-stream segments are within 300 feet of the stream.

Near-stream segments have two end-points but do not have a right bank, mid-point and left bank. Mark a GPS location point at both ends of the near-stream segment. Document a unique

ID for each point on the worksheet and record the HCS data only once in the GPS; either end-point is acceptable.

HCS Road Surface Erosion

Observe for road erosion features—surface erosion (sheet wash), rills and gullies, ruts, inside ditch erosion, and diversion potential. The following table describes each road erosion feature collected in the HCS.

Table 15. HCS Road Surface Erosion Descriptions

Erosion Type	Description
Sheet	A uniform wash of fine sediment.
Rills/Small Gully	A linear incision into the road surface < 12 inches deep.
Medium Gully	A linear incision into the road surface 12-24 inches deep.
Large Gully	A linear incision into the road surface more than 24 inches deep.
Small Rut	Depressions into the road surface cause by vehicle tires that are 2-6 inches deep.
Large Ruts	Depressions into the road surface cause by vehicle tires that are deeper than 6 inches.
Inside Ditch	On road segments designed as insloped where drainage is concentrated in a ditch between the road surface and the cut slope, drainage is carried away from the road at cross drains at designed interval. The connection is the length of scoured ditch line that drains water into a stream.
Diversion Potential	These are locations where water may be diverted from a designed drainage passage beneath the road and then runs down and eventually off the road beyond the limits of the intended drainage (road fill at a culvert crossing).

Figure 2 shows the diversion potential where the crossing has failed, and the road grade has diverted the streamflow out of the channel and down the road, resulting in erosion and downstream sedimentation.

Figure 2. Diversion Potential

Document the length of surface erosion on the worksheet (in feet) and record in the GPS unit for RB, LB and NS HCS segments.

Large Erosion Features within the HCS

While inventorying the HCS segment, observe evidence of large erosion features such as, cut and fill failure (slumps, landslides and large gullies), road washouts, and mudholes. Mark and record a GPS point for each observation. Estimate the total volume of soil loss in cubic yards and document on the worksheet (a standard dump truck carries 10 cubic yards; visualize this to help estimate volume of cut and fill material). Also note if the erosion has reduced the travel width; for example, a cut slope failure that has covered part of the road surface. In the GPS

unit select "SinglePt" from the HCS local field, the type of erosion from the large-soil-loss-type field, and record the estimated amount of soil loss in the large-soil-loss-amount field. The following table defines types of large erosion features.

Table 16. Large Erosion Features

Erosion Feature	Description
Fill Erosion	Fill slope erosion (> 5 cubic yards soil loss) such as slumps, slides or gullies > 24".
Cut Erosion	Cut slope erosion (> 5 cubic yards soil loss) such as slumps, slides or gullies > 24".
Partial Washout	Partial road prism washout (can still drive around washout)
Full Washout	Road prism is completely washout and not passable
Potholes	Several potholes concentrated in a single area that is effecting safe travel and/or causing resource damage.
Mudhole	Large (> 15') mudhole that is effecting safe travel and/or causing resource damage.

HCS Road Gradient Measurement

Using a clinometer, measure the average road gradient percentage and the distance of each measurement for the entire length of the RB and LB separately. It may be necessary to collect more than one measurement to account for change in slope along the segment. Document each measurement on the HCS worksheet and calculate the weighted average (see worksheet for instructions) for the RB and LB. Round the weighted average to the nearest whole number. Enter the weighted average grade percent for the RB and LB in the GPS unit.

HCS Stream Crossing Fill Dimensions

Measure the width and height of each stream crossing culvert fill and document on the HCS worksheet. Average the inlet and outlet heights. There can be more than one culvert within an HCS. Record the fill dimensions for each stream crossing culvert on the GPS unit in the Drain Structure feature class.

1. Fill width is measured as the distance in feet of the road surface from one edge of the traveled way to the other.
2. Fill height is measured as the vertical distance in feet from the streambed to the road surface at the outlet and at the inlet of the structure. Average the two fill height measurements and record the average in the GPS unit.

Note: only collect and record fill dimensions if there is no diversion potential.

Drain Structures Feature Class

Identifying the drainage structures (i.e., culverts, bridges and fords) and their condition along a road assists managers in determining the ability of the road system and stream channels to accommodate surface flow and runoff.

Objective of this measurement

Identify drainage structures that are at risk of failure or are non-functioning and may affect stream channels or road use. This will provide information for road engineers to work toward implementation of road and culvert maintenance.

Where to take this measurement

At each stream crossings and cross drain culverts on assigned roads designated for inventory.

How to take this measurement

At each stream crossing and cross drain culvert collect the type of drain feature, size, material type, and condition. Take a photo of all damaged culverts.

Drain Feature Type

Drainage Feature Type: this data differentiates between drainage features that are at stream crossings or cross drain culverts along a road. Select the appropriate item from the drop down list either (Cross Drain or Stream Crossing).

Drain Feature

This identifies the actual drain feature, such as a culvert or bridge. There are several types of cross drains (e.g., culverts, drivable water bar, rolling dips) but for the purpose of this survey, only cross drain culverts will be inventoried. Stream crossings can have different drain feature types, such as a culvert, bridge or ford (a low water crossing constructed of native material, rock or concrete). Select the appropriate item from the drop down list (i.e., Bridge, Culvert, Ford or Other).

Culvert Size

Measure the height (inches) of all round culverts and select the appropriate number from the drop down menu provided. If the drain feature is an elliptical culvert or arch, select that item from the drop down menu and document the height in comments.

Material

Select the drain feature material. Use the dropdown list—aluminum, steel, plastic, concrete, rock, native.

Culvert Condition

Identify the culvert condition for both the inlet and outlet. Determine if the culvert is open and functioning, plugged and/or damaged. Inspect the inlet for debris in the catch basin or obstructions at the culvert inlet opening, and identify any inlet damage that reduces the culvert's effectiveness (i.e., partially crushed pipe). Walking down hill to culvert outlets is needed only if there is damage to the inlet that indicates there may be a problem at the outlet. Each culvert outlet should be observed from the road to see if it projects beyond the fill (a "shotgun"). Select the appropriate drop down option; see the tables below for culvert condition descriptions.

Table 17. Culvert Inlet Condition Descriptions

Culvert Condition	Description
Open	Culvert is open and functioning.
Plug Partial	Culvert is partially plugged.
Plug Complete	Culvert is completely plugged.
Plug-Damage	Culvert is plugged with inlet damage.
Dmg Inlet	There is damage to the culvert inlet.
Dmg Drop	There is damage to the drop inlet.
Combo-other	There is a combination of plugged and damage to the inlet. Document the type of plugging and damage in comments.
UK	Unknown – inlet is not visible or accessible due to vegetation and/or steep slope.

Table 18. Culvert Outlet Condition Descriptions

Culvert Condition	Description
Open	Culvert is open and functioning.
Dmg-Outlet	Culvert is damaged at the outlet.
Buried-Outlet	Culvert outlet is buried by vegetation and/or earth.
Shotgun	A shotgun culvert extends out past the road fill above the natural flow (gradient) of the channel creating a waterfall effect.
Combo-Other	A combination of the above culvert conditions.
UK	Unknown – outlet is not visible or accessible due to vegetation and/or steep slope.

Basin Condition

A basin is constructed immediately upstream of culvert openings to slow water velocity and trap sediment before water flows through the culvert. Basins can accumulate moveable debris such as tree limbs and sediment that can block the culvert inlet during higher flows.

Identify if the basin is full of moveable debris that needs to be removed. Select the appropriate option from the drop down list provided. The following table describes these options.

Table 19. Basin Condition Descriptions

Basin Condition	Description
Clear	The basin above the culvert inlet is free and clear of debris.
Veg_Debris	There is moveable debris in the basin above the culvert blocking the inlet and should be removed.
Sediment	Sediment in basin is blocking culvert.
Other	Document other significant information regarding the culvert basin in comments.

Flow Regime

Select the appropriate flow regime from the drop down menu using field indicators (see table below). If documenting a cross drain culvert select "No-Xing".

Table 20. Flow Regime Field Indicators

Flow Regime	Field Indicators
Perennial	Flowing water is present all summer; obligate riparian vegetation is common.
Intermittent	Flowing water part of the summer or streambed is damp; may be patchy riparian vegetation.
Ephemeral	Drainage is absent of flowing water in summer, streambed dry and no riparian vegetation.
Spring/Seep	Water emanates from the ground; spring has downstream surface flow, seep does not.

Road Points Feature Class

The Road Points feature class is to record termini points for the beginning and ending of roads, road sections and road logs. Other road related features included in this feature class are constructed features, road closures, access needs and invasive weeds.

Objective of this measurement

Identify and document location and condition of road related features having bearing on access need and road infrastructure.

Where to take this measurement

At each road feature encountered along roads assigned for inventory. Invasive weed points are optional and may be recorded where obvious infestations are observed.

How to take this measurement

At each feature encountered along the roadway mark a GPS point of the location and record the attributes. Select the appropriate item from the drop down menus provided.

Terminus Point ID and Description

For each road, road section and road log, mark a point and record the terminus point ID (Term_Pt_ID) and the terminus point type (Term_Pt_Type). Number each unique terminus point ID with the following naming convention, yy#### (e.g., 110001, 110002, 110003…110136). Number each point consecutively for the entire project. Do not repeat numbers. Table 20 describes the terminus point types used to identify each unique point ID.

Table 21. Terminus Point Description

Terminus Point Type	Description
BOR	Beginning of Road
BOL	Beginning of Log: log begins in the middle of a road.
SectionPt	Begin or end of road section.
EOR_NoPrism	End of Road No Prism: end of road, no visible road prism.
EOR_Intersection	End of Road at intersection of another road. The route does not continue.
Change_to_Trail	Road changes into a trail (motorized and/or non-motorized)
EOL	End of Log: Road log ends in the middle of a road.
EOL PVT	End of Log Private: road log ends at private property.
Undriveable	Road prism continues but is not driveable in a standard vehicle (e.g., SUV, pick-up, 4x4).

Document the terminus point ID number on the road streaming worksheet (begin and end point ID fields) and record them in the GPS unit road streaming feature class.

Road Point Features and Conditions

The following tables define the fields related to road features and their condition.

Table 22. Constructed Feature Descriptions

Constructed Feature	Description
Barrier-MM	Constructed (man-made) road closure barrier.
Barrier-Natural	Natural barrier: road is blocked to motor vehicle traffic by naturally occurring barriers such as vegetation, washout, landslide, or fallen tree.
Catl-Guard	Cattle guard: collect a GPS point and determine if the cattle guard is functioning (cattle cannot cross), in some cases cattle guards can fill up with sediment or be physically damaged and cease to function. If this is the case select damaged and document the condition in comments.
Catl-Guard Gate	Cattle guard with associated gate.
Bate-BW	Barbed wire gate
Gate-Cable	Cable gate
Gate-Stock	Livestock Gate (e.g., Powder River Gate).
Gate-Traffic	Traffic gate (pipe)
Road Num Sign	Road marker sign

Table 23. Closure Feature Descriptions

Closure Feature	Description
Bar-Berm	Earth berm barrier
Bar-Boulder	Boulder barrier
Bar-Log Earth	Log and earth barrier
Overgrown	Brush or live trees block road
Trees Down	Fallen trees block road
Washout	Washout blocks road
Other	Other - input in comments

Table 24. Feature Condition Descriptions

Condition	Description
Functioning	Road addition feature is functioning satisfactorily
Damaged	Road addition feature is damaged or not functionally properly; for example, a gate that does not lock properly (post line-up), or a sediment filled cattle guard.
Incorrect	Route marker sign incorrect label
Breached	Road addition feature such as a barrier that is breached.

Access Need

The access features in the Road Points feature class has a similar list of values as Table 11, Observed Uses. Record the access feature in the road points feature class when observing a site with significant evidence of why the route is needed. Table 25 lists possible access features including dispersed campsites.

Identifying dispersed campsite locations is a travel management analysis priority. In addition categorizing them within 100 feet of a waterbody or outside is useful for watershed management.

Mark the location of each dispersed campsite encountered and select the appropriate distance item from the access feature list (i.e., Disp CS < 100 or Disp CS > 100). Do not select a condition for dispersed campsites. If there is, any significant, water or road related issues caused by the campsite document them in comments.

Table 25. Access Feature Descriptions

Field Value	Description
AdmnSite	USFS administrative site
Boating	Boat ramp or put-in
Canal	Canal, water transmission ditch or flume
CommSite	Communications antenna site
DevRec	Developed recreation site
Disp CS < 100	Dispersed campsite within 100' of water.
Disp CS > 100	Dispersed campsite greater than 100' from water.
Landing	Log landing
Mine	Mine tunnel or shaft
Penstock	Hydropower pipe conducting water to generator
Raft	Raft put-in
Range	Stock corral, fence, trough or salt station
Rock	Rock quarry or borrow pit
Util	Power or phone tower or pole

Noxious Weeds (optional)

Identifying noxious weed populations is optional.

Noxious weeds can be very harmful and can spread across the landscape. They spread aggressively and crowd out native species, increase fire risk and add to the costs of maintaining roads, and waterways. Collecting noxious weed location data can help managers with weed control projects.

There are five types of weeds of concern on the Stanislaus National Forest (Brooms, Grasses, Tree of Heaven, Spurge, and Thistles). The following table lists the common and scientific names of these species. There is more than one type of broom, grass, and thistle, so for the purpose of this survey only identify (from the data selection list) if it is a broom, grass or thistle.

Refer to the Noxious Weed Guide, Stanislaus National Forest Known and Potential Weeds, when identifying noxious weeds.

Table 26. Stanislaus National Forest Noxious Weeds of Concern

Field Value	Common Name	Scientific Name
Broom	French Broom	Genista monspessulana
	Scotch Broom	Cytisus scoparius
	Spanish Broom	Spartium junceum
Grass	Barbed Goatgrass	Aegilops truncialis
	Medusahead	Taeniatherum caput-medusae
Heaven	Tree of Heaven	Ailanthus altissima
Spurge	Oblong Spurge	Euphorbia oblongata
Thistle	Yellow Starthistle	Centaurea solstitialis
	Italian Thistle	Carduus pycnocephalus
	Tocolete	Centaurea melitensis

Appendices

Appendix A: ArcPad Geodatabase Structure

This section describes the structure of the ArcPad geodatabase developed for this inventory. A geodatabase can hold many types of spatial data stored in tables. These tables, called feature classes, are structured with fields and domains. A field identifies each attribute collected for this inventory and the domains are defined values (aka, drop down menus) used in many of the fields. There are seven feature classes in this geodatabase; their structure is detailed in the following tables.

Road Streaming Feature Class

This feature class is for recording basic road information such as location, use and surface material.

Field	Field Description	Domain	Domain Values	Domain Description
RouteID	Enter Route ID Number (e.g., 03N01, 2S04YA, FR8323. 15EV59); Routes—not documented on existing maps or in GIS—need to be identified with a unique route identifier, 3 initials + date (mmddyy) + 24-hour time (hhmm), for example, slg0511100852. The 24-hour time stamp is very important to give each ID a unique identifier.	None		
Bgn_Pt_ID	Unique Identifier for Point feature at beginning of Road Streaming line feature. Naming Convention yy#### (e.g., [number consecutively] 110001, 110002, 110003,…110137).	None		
End_Pt_ID	Unique Identifier for Point feature at end of Road Streaming line feature. Naming Convention yy#### (e.g., [number consecutively] 110001, 110002, 110003,…110137).	None		
Section_	Road section number	None		
RdSurface	Road Surface Material	Surface	Native	Native soil, constructed by equipment
			Aggregate	Aggregate - crushed rock
			Asphalt	Asphalt, approx. 2" thick
			Chip Seal	Similar to asphalt but 3/4" or less thick. If less than 50% coverage show as Aggregate.
			Improved	Mostly native but with improved surface like aggregate in places
			Primitive	Primitive - user created route - no cut or fill
			Other	Describe other surface material in comments

Field	Field Description	Domain	Domain Values	Domain Description
Des_Veh	Design Vehicle - the largest or most limiting vehicle that could drive this road as it was originally constructed. Look at template from shoulder to shoulder.	Des_Veh	LogTruck	At least 12' wide, grade < 17%, curve radius at least 50 '
			Pickup	At least 8' wide, grade < 17%, curve radius at least 30'
			4WD	Can be driven by full width short wheelbase 4WD vehicle
			Other	Describe other or unknown design vehicle in comments.
			Skidder	Originated as skid trail. Skid trails radiate out from landings.
			Railroad	Originated as RR. Grade < 3%, through cuts, RR artifacts may be present.
Cur_Veh	Current Vehicle - the largest or most limiting vehicle that could drive this road in its current condition.	Cur_Veh	Car-fast	Low Clearance Vehicle - Smooth surface, similar to highway, 25 mph in 2WD passenger car (ML5)
			Car-slow	Low Clearance Vehicle - Surface as smooth as graded aggregate, OK for 2WD passenger car (ML3)
			LogTruck	Smooth enough and cleared wide enough (12') for log truck (ML2)
			Pickup	Medium Clearance Vehicle - Smooth enough and cleared wide enough (6') for 2WD pickup (ML2-pickup)
			4WD	High Clearance Vehicle - Requires 4WD because of steep pitches. Can drive in 4WD pickup or SUV (ML2-4WD)
			ATV	50" clear width, can drive in quad (ML2-ATV)
			Motorcycle	Single track, motorcycle only (ML1-MC)
			Blocked	Closed to motor vehicle traffic by man-made barrier (ML1)
			Undriveable	Closed to motor vehicle traffic by natural causes such as vegetation or washout (ML1-natural)
			Other	Other - input in comments
Traf_Vol	Traffic Volume: the amount of estimated traffic use.	TrafficVolume	Frequent	Frequent: route used regularly (bare mineral soil along traveled way)
			Infrequent	Infrequent: route used infrequently (grass or low brush in traveled way; wheel tracks evident)
			None	None: no motor vehicle traffic (traveled way revegetated or covered with duff layer; no evidence of wheel tracks)

Field	Field Description	Domain	Domain Values	Domain Description
Ob_Use	Optional - The type of access for which the road is currently used, if obvious from on-site evidence. Leave blank if no evidence is seen.	Ob_Use	AdmnSite	USFS administrative site
			Boating	Boat ramp or put-in
			Canal	Canal, water transmission ditch or flume
			CommSite	Communications antenna site
			DevRec	Developed recreation site
			DispCampsite	Dispersed camping Site
			Driving	Driving for pleasure, 2WD car standard
			Fire	Initial attack or water drafting
			Logging	Log landing
			Mine	Mine tunnel or shaft
			Multi	More than one use or purpose
			NonMotor	Non-motorized use - hiking, equestrian
			OHV	Driving for pleasure, 4WD or ATV standard
			Other	Input in Comments
			Penstock	Hydropower pipe conducting water to generator
			Raft	Raft put-in
			Range	Stock coral, fence, trough or salt station
			Rock	Rock or soil quarry
			Util	Power or phone tower or pole
			WaterDraft	Water drafting site
			Redundant	Another route provides better access
			Unneeded	Obviously no current needed
Date_Inv	Enter date, format: mm/dd/yyyy	None		
PhotoID	Take photos of notable items, damage, and large erosion features. Input the photo number (last 4 digits) after "IMGP", camera alpa identifer (no spaces); followed with an underscore and the route number (e.g., IMGP0014A_1N03, IMGP0006A_slg0511100852).	None		
Comments	Document notes and comments	None		
Observer	Select the observer who entered data into the data recorder.	Observer	S. Bear	Hydrologic Technician
			W. Owl	Forestry Technician
ReviewedBy	First initial and last name of person reviewing (QA) field data (office exercise).	None		
Review Comment	Comments regarding review of field data (office Exercise).	None		

Road Risk Line Feature Class

This feature class is for recording resource impact and safety risks as line features. Hydrology related risks within HCS segments are recorded in the HCS feature class and are not included in the Road Risk feature class.

Field	Field Description	Domain	Domain Values	Domain Description
RouteID	Enter Route ID Number (e.g., 03N01, 2S04YA, FR8323. 15EV59); Routes—not documented on existing maps or in GIS—need to be identified with a unique route identifier, 3 initials + date (mmddyy) + 24-hour time (hhmm), for example, slg1005110852. The 24-hour time stamp is very important to give each ID a unique identifier.	None		
Attention	Denote urgent need for attention	Attention	Urgent Safety	Urgent safety situation
			Urgent Resource	Urgent resource impact situation
			Other	Other - input in comments
Risk_Feature	Unique Identifier for Point feature at end of Risk line.	Risks	Berm	Road edge berm blocks drainage
			Erosion Cut Bank	Erosion of cut bank
			Erosion Fill Bank	Erosion of fill bank
			Erosion Rd Surf	Erosion of road surface
			Hill Climb	Unauthorized hill climb
			Hillslope Gully	Gully on hillslope above or below road
			Landslide	Landslide, debris flow, mass wasting
			Meadow Xing	Road passes through meadow
			Mudhole	Depression larger than approx 8', filled with water in wet season
			Pothole	Depression up to approx 6' diameter
			Trough	Road is lower than surrounding land
			Washout Partial	Washout eroding part of road
			Washout Full	Washout blocking all traffic
			Wet Area	Road bed wet most of the year
Grade	Enter percent grade to the nearest whole number. *Note where the slope is much steeper than the rest of the route resulting in an access blockage (>17% for trucks & 2WD).*	None		
Er_Rate	Describes whether erosion has stabilized or continues	Er_Rate	Stable	Erosion stabilized, not growing
			Active	Erosion continuing or increasing
Er_Width	Representative (average) width of erosion feature in feet	None		
Er_Depth	Representative (average) depth of erosion feature in feet	None		
Er_Percent	Percent of the risk line feature covered by the representative width & depth erosion . Show 100% as 100.	None		
Date_Inv	Enter date, format: mm/dd/yyyy	None		

Field	Field Description	Domain	Domain Values	Domain Description
PhotoID	Take photos of notable items, damage, and large erosion features. Input the photo number (last 4 digits) after "IMGP", camera alpa identifer (no spaces); followed with an underscore and the route number (e.g., IMGP0014A_1N03, IMGP0006A_slg0511100852).	None		
Comments	Document notes and comments	None		
Observer	Select the observer who entered data into the data recorder.	Observer	S. Bear	Hydrologic Technician
			W. Owl	Forestry Technician
ReviewedBy	First initial and last name of person reviewing (QA) field data (office exercise).	None		
Review Comment	Comments regarding review of field data (office Exercise).	None		

Road Risk Point Feature Class

This feature class is for recording resource impact and safety risks as point features. Hydrology related risks within HCS segments are recorded in the HCS feature class and are not included in the Road Risk feature class.

Field	Field Description	Domain	Domain Values	Domain Description
RouteID	Enter Route ID Number (e.g., 03N01, 2S04YA, FR8323. 15EV59); Routes—not documented on existing maps or in GIS—need to be identified with a unique route identifier, 3 initials + date (mmddyy) + 24-hour time (hhmm), for example, slg1005110852. The 24-hour time stamp is very important to give each ID a unique identifier.	None		
Attention	Denote urgent need for attention	Attention	Urgent Safety	Urgent safety situation
			Urgent Resource	Urgent resource impact situation
			Other	Other - input in comments

Field	Field Description	Domain	Domain Values	Domain Description
Risk_Feature	Unique Identifier for Point feature at end of Risk line.	Risks	Berm	Road edge berm blocks drainage
			Erosion Cut Bank	Erosion of cut bank
			Erosion Fill Bank	Erosion of fill bank
			Erosion Rd Surf	Erosion of road surface
			Hill Climb	Unauthorized hill climb
			Hillslope Gully	Gully on hillslope above or below road
			Landslide	Landslide, debris flow, mass wasting
			Meadow Xing	Road passes through meadow
			Mudhole	Depression larger than approx 8', filled with water in wet season
			Pothole	Depression up to approx 6' diameter
			Trough	Road is lower than surrounding land
			Washout Partial	Washout eroding part of road
			Washout Full	Washout blocking all traffic
			Wet Area	Road bed wet most of the year
Grade	Enter percent grade to the nearest whole number. *Note where the slope is much steeper than the rest of the route resulting in an access blockage (>17% for trucks & 2WD).*	None		
Er_Rate	Describes whether erosion has stabilized or continues	Er_Rate	Stable	Erosion stabilized, not growing
			Active	Erosion continuing or increasing
Er_Width	Representative (average) width of erosion feature in feet	None		
Er_Depth	Representative (average) depth of erosion feature in feet	None		
Er_Percent	Percent of the risk line feature covered by the representative width & depth erosion . Show 100% as 100.	None		
Date_Inv	Enter date, format: mm/dd/yyyy	None		
PhotoID	Take photos of notable items, damage, and large erosion features. Input the photo number (last 4 digits) after "IMGP", camera alpa identifer (no spaces); followed with an underscore and the route number (e.g., IMGP0014A_1N03, IMGP0006A_slg0511100852).	None		
Comments	Document notes and comments			
Observer	Select the observer who entered data into the data recorder.	Observer	S. Bear	Hydrologic Technician
			W. Owl	Forestry Technician
ReviewedBy	First initial and last name of person reviewing (QA) field data (office exercise).	None		
Review Comment	Comments regarding review of field data (office Exercise).	None		

Hydrologically Connected Segment (HCS) Feature Class

This feature class is for recording Hydrologically Connected Segment (HCS) data. It contains fields that identify hydrologically connected roads at stream crossings and near-stream, and HCS erosion conditions (e.g., rill and gully erosion, diversion potential and percent grade).

Field	Field Description	Domain	Domain Values	Domain Description
RouteID	Enter Route ID Number (e.g., 03N01, 2S04YA, FR8323. 15EV59); Routes—not documented on existing maps or in GIS—need to be identified with a unique route identifier, 3 initials + date (mmddyy) + 24-hour time (hhmm), for example, slg1005110852. The 24-hour time stamp is very important to give each ID a unique identifier.	None		
HCS_Sec	Erosion **Section** number - from HCS worksheet	None		
HCS_Seg	Erosion **Segment** number - from HCS worksheets	None		
HCS_Type	Select stream crossing or near stream	HCS_Type	StreamXing	Road crosses the stream channel.
			NearStream	Road runs parallel to the stream channel, usually within 300".
HCS_Local	"Mark" and "Record" the location of HCS data to be recorded (i.e., left bank, mid point, right bank or near stream). Always "Mark" a mid-point. When you encounter a "Large" erosion feature (e.g., slope failure, road washout) "Mark" a point, record the soil loss type and amount in the GEODB, take photos and document on the comment and photo log.	HCS_Local	RB-HCS	Record Right Bank Data
			LB_HCS	Record Left Bank Data
			MP-HCS	Mid-point of HCS (do not record erosion or grade data here).
			NS-HCS	Near Stream is a segment of road parallel to and within 300' of a waterbody. "Mark"data points (2 points taken, one at either end). Record data only once for each near stream segment. Recording data at either end is ok.
			SinglePt	Large "Single Erosion Point" along the road (e.g., fill/cut slope failure, large road surface gully, large slump or slide, or partial/complete road prism washout). Take a photo and document description in comments. Does not need a Unique ID.
GPSPt_ID	Unique Identifier for RB or LB of HCS, and a single erosion point. Naming Convention yy#### (e.g., [number consecutively] 110001, 110002, 110003,…110137).	None		
Pair_Point	Unique Identifier for mid point of HCS. Naming Convention yy#### (e.g., [number consecutively] 110001, 110002, 110003,…110137).	None		

Field	Field Description	Domain	Domain Values	Domain Description
HCS_LgSoilLossType		LgSoilLossType	Gully > 24"	Delete from here, is calculated in the surface erosion
			Fill Erosion	of cut and fill erosion that is greater than 5 cubic yards
			Cut Erosion	
			Partial WO	Partial Washout (can still drive around washout)
			Full WO	Road is completely washout and not passible
			Potholes	
			Mudhole	
HCSLgSoilLossAmt		None		
HCS_SE	HCS_SE - Sheet Erosion (sheet wash erosion). Input total SE distance in ft.	None		
HCS_RG	HCS - Rills and small gullies are less than 12" deep. Input total rill/small gully distance in feet.	None		
HCS_MG	HCS_MG - Medium Gully Erosion, 12"-24" deep (min. 6" wide). Input total MG distance in ft.	None		
HCS_LG	HCS_LG - Large Gully Erosion, > 24' deep (min. 6" wide). Input total LG distance in ft.	None		
HCS_SR	HCS - Small Ruts < 6" in depth are wide deep depressions in the road running surface typically due to wet weather traffic or over-loading of the road surface. A minimum threshold of 2 inches in depth with continuity. Record total SR distance.	None		
HCS_LR	HCS- Large Ruts 6" - 12" in depth are wide deep depressions in the road running surface typically due to wet weather traffic or over-loading of the road surface. A threshold of 6 inches in depth with continuity. Record total LR distance.	None		
HCS_ID	HCS_ID - Inside Ditch Erosion. Input total ID distance in ft.	None		
HCS_DP	DP - Diversion Potential (at stream crossings). Input total DP distance in ft. Enter diversion length (feet) in whole numbers (e.g. 50, 265). The diversion potential length is measured from the point where the stream flow leaves the channels and travels down the road prism to where the flow leaves the road.	None		
HCS_Grade	Weighted Average Grade % - document the weighted average calculation from the HCS worksheet (round to the nearest whole number).	None		
Date_Inv	Enter date, format: mm/dd/yyyy	None		

Field	Field Description	Domain	Domain Values	Domain Description
PhotoID	Take photos of notable items, damage, and large erosion features. Input the photo number (last 4 digits) after "IMGP", camera alpa identifer (no spaces); followed with an underscore and the route number (e.g., IMGP0014A_1N03, IMGP0006A_slg0511100852).	None		
Comments	Document notes and comments	None		
Observer	Select the observer who entered data into the data recorder.	Observer	S. Bear	Hydrologic Technician
			W. Owl	Forestry Technician
ReviewedBy	First initial and last name of person reviewing (QA) field data (office exercise).	None		
Review Comment	Comments regarding review of field data (office Exercise).	None		

Drain Structure Feature Class

This feature class is for recording all cross drain culverts and stream crossing structures (i.e., culverts, bridges and fords). It contains fields for documenting stream crossing and cross drain structure characteristics and conditions (e.g., size, function, flow regime).

Field	Field Description	Domain	Domain Values	Domain Description
RouteID	Enter Route ID Number (e.g., 03N01, 2S04YA, FR8323. 15EV59); Routes—not documented on existing maps or in GIS—need to be identified with a unique route identifier, 3 initials + date (mmddyy) + 24-hour time (hhmm), for example, slg1005110852. The 24-hour time stamp is very important to give each ID a unique identifier.			
DrainFeatType	Drainage Feature Type: Is the feature a cross drain culvert or stream crossing?	Drain_Feature_Type	CrossDrain	Cross Drain Culvert (inside ditch relief; no fill dimensions needed).
			StrmXing	Stream Crossing (collect fill dimensions unless there is a diversion potential, in this case no fill dimensions are needed).
DrainFeat	Drainage Feature: What is the drain feature?	Drain_Feature	Bridge	Bridge - Do not need to collect bridge dimensions.
			Culvert	Culvert
			Ford	Ford, low water crossing (no dimensions needed).
			Other	Describe other drain feature in the comments (e.g., basin above road with no culvert)

Field	Field Description	Domain	Domain Values	Domain Description
CulvertSize	Drainage Size (inches): What is the size of the drain feature?	Clvt_Size	12	12 " round pipe
			18	18" round pipe
			24	24" round pipe
			30	30" round pipe
			36	36" round pipe
			48	48" round pipe
			60	60" round pipe
			72	72" round pipe
			Arch	Bottomless arch - Input arch height in comments
			Elliptical	Elliptical pipe - Input height in comments
			Other	Describe other drain size/dimensions in the comments
			N/A	Not applicable
Material	Drainage/Pipe Material: What type of material is the drain feature constructed of?	Material	Aluminum	Aluminum (pipe)
			Steel	Steel (pipe)
			Plastic	Plastic (pipe)
			Concrete	Concrete (pipe/ford)
			Rock	Rock (ford)
			Native	Native (ford)
			Other	Describe other material in the comments
InletCond	Culvert Condition: What is the condition at the inlet of the drain feature (Culvert)? Take a picture of all damaged culverts.	InletCond	Open	Culvert open and functioning
			Plug-Partial	Culvert partially plugged(can still see daylight)
			Plug-Complete	Culvert completely plugged (can not see daylight)
			Plug-Damage	Plugged and inlet damage
			Dmg-Inlet	Damaged culvert inlet
			Dmg-Drop	Damaged culvert drop inlet
			Combo-Other	Any combination of above or other condition (document in comments)
			UK	Unknown, inlet is not visible or accessable due to vegetation and/or steep slope.
			N/A	Not applicable (not a culvert)
OutletCond	Culvert Condition: What is the condition at the outlet of the drain feature (Culvert)? Take a picture of all damaged culverts.	OutletCond	Open	Culvert open and functioning
			Dmg-Outlet	Damaged culvert outlet
			Burried-Outlet	Outlet is burried by veg and/or earth
			Shotgun	A shotgun culvert extends out past the fill above the natural flow of the channel creating a waterfall effect.
			Combo-Other	Any combination of above or other condition (document in comments)
			UK	Unknown, outlet is not visible or accessable due to vegetation and/or steep slope.
			N/A	Not applicable (not a culvert)

Field	Field Description	Domain	Domain Values	Domain Description
Basin	What is the condition of the basin above the culvert? Is it full of debris and in need of cleaning?	Basin	Clear	Basin above culvert inlet is clear of debris.
			Sediment	Sediment in basin is blocking culvert.
			Veg_Debris	Vegitation debris in basin is blocking culvert inlet and should be removed.
			N/A	Not applicable
			Other	Other significant information regarding the basin input in comments.
Flow	Streamflow Regime: What is the flow regime for this feature, select No-Xing if it is a cross drain culvert.	Flow	Perennial	Perennial (P)
			Intermittent	Intermittent (I)
			Ephemeral	Ephemeral (E)
			Spring/Seep	Spring/Seep (S/S)
			No-Xing	No Stream Crossing (N/A)
HCS_Fill_W	HCS_FD_W - Fill Dimension Width. NOTE, fill dimensions are not required for cross drain culverts or if the crossing has diversion potential.			
HCS_Fill_H	HCS_FD_H - Fill Dimension Height (average height of the outlet and inlet fill). NOTE, fill dimensions are not required for cross drain culverts or if the crossing has diversion potential.			
Date_Inv	Enter date, format: mm/dd/yyyy			
PhotoID	Take photos of notable items, damage, and large erosion features. Input the photo number (last 4 digits) after "IMGP", camera alpa identifer (no spaces); followed with an underscore and the route number (e.g., IMGP0014A_1N03, IMGP0006A_slg0511100852).			
Comments	Document notes and comments			
Observer	Select the observer who entered data into the data recorder.	Observer	S. Bear	Hydrologic Technician
			W. Owl	Forestry Technician
ReviewedBy	First initial and last name of person reviewing (QA) field data (office exercise).			
Review Comment	Comments regarding review of field data (office Exercise).			

Road Point Feature Class

This feature class is for recording record termini points for Road Streaming and Road Risk line features, and to record points related to road closures, constructed features, access needs and invasive weeds.

Field	Field Description	Domain	Domain Values	Domain Description
RouteID	Enter Route ID Number (e.g., 03N01, 2S04YA, FR8323. 15EV59); Routes—not documented on existing maps or in GIS—need to be identified with a unique route identifier, 3 initials + date (mmddyy) + 24-hour time (hhmm), for example, slg1005110852. The 24-hour time stamp is very important to give each ID a unique identifier.		None	
Term_Pt_ID	Unique Identifier for terminus type point features. Naming Convention yy#### (e.g., [number consecutively] 110001, 110002, 110003,…110137).		None	
Term_Pt_Type	Select the terminus type the best describes what lies beyond the terminus point (e.g., EOR_No Prism, or Cahnge to trail); or select the the begin or end or road, or risk line.	Term_type	BOR	Beginning of Route
			BOL	Beginning of Log: log begins in middle of route.
			SectionPt	Begin or end of route section.
			EOR_NoPrism	End of Route No Prism: end of route no visible road prism.
			EOR_Intersection	End of Route at intersection of another route. The route does not continue on.
			Change_to_Trail	Road changes into a trail (motorized and/or non-motorized)
			EOL	End of Log: Road log ends in middle of route.
			EOL PVT	End of Log Private: road log ends at private property.
			Undrivable	Route prism continues on but is not driveable in a standard vehicle (e.g., SUV, pick-up, 4x4).
ClosureType	Man-made or natural features closing a road to motor vehicle traffic. Do not include gates if they are open.	ClosureType	Bar-Berm	Earth berm barrier
			Bar-Boulder	Boulder barrier
			Bar-Log Earth	Log and earth barrier
			Overgrown	Brush or live trees block road
			Trees Down	Fallen trees block road
			Washout	Washout blocks road
			Other	Other - input in comments
Constructed Feature	Constructed features. These features should be recorded whenever encountered.	ConstFeat	Barrier-MM	Constructed (man-made) rode closure barrier
			Catl Guard	Cattle guard
			Catl Guard Gate	Cattle guard with gate
			Gate-BW	Barbed wire gate
			Gate-Cable	Cable gate
			Gate-Stock	Livestock Gate (e.g., Powder River Gate)
			Gate-Traffic	Traffic gate (pipe)
			Road_Sign	Road number (marker) sign
			Other	Other - input in comments

Field	Field Description	Domain	Domain Values	Domain Description
ConstrFeatCnd	Condition of constructed feature	RdFeatCond	Functioning	Road feature is functioning satisfactory
			Damaged	Road feature damaged - take a photo and document in comments.
			Breached	Road feature breached (barrier)
			Incorrect	Road marker sign incorrect label
			Other	Other - input in comments
Access Feat	Sites for which road access is needed or desired. These sites help determine the level of need for open road access. Landings and utility poles are very common and need not be recorded unless significant for being the only indication of need for a minor road.	AccessFeat	AdmnSite	USFS administrative site
			Boating	Boat ramp or put-in
			Canal	Canal, water transmission ditch or flume
			CommSite	Communications antenna site
			DevRec	Developed recreation site
			Disp CS < 100	Dispersed camp site within 100' of water.
			Disp CS > 100	Dispersed camp site greater than 100' from water.
			Landing	Log landing
			Mine	Mine tunnel or shaft
			Penstock	Hydropower pipe conducting water to generator
			Raft	Raft put-in
			Range	Stock corral, fence, trough or salt station
			Rock	Rock quarry or borrow pit
			Util	Power or phone tower or pole
			Other	Other - input in comments
Attention	Denote urgent need for attention	Attention	Urgent Safety	Urgent safety situation
			Urgent Resource	Urgent resource impact situation
			Other	Other - input in comments
Weed	OPTIONAL FIELD - Noxious weeds, only record significant occurances of weeds.	Weed	Broom	Spanish broom; French broom; Scotch broom
			Grass	Barbed goat grass; Medusa head
			Heaven	Tree of Heaven
			Spurge	Oblong spurge
			Thistle	Yellow starthistle; Italian thistle; Tocalete
			Other	e.g., Himalyan black berry
Date_Inv	Enter date, format: mm/dd/yyyy		None	
PhotoID	Take photos of notable items, damage, and large erosion features. Input the photo number (last 4 digits) after "IMGP", camera alpa identifer (no spaces); followed with an underscore and the route number (e.g., IMGP0014A_1N03, IMGP0006A_slg0511100852).		None	
Comments	Document notes and comments		None	
Observer	Select the observer who entered data into the data recorder.	Observer	S. Bear	Hydrologic Technician
			W. Owl	Forestry Technician
ReviewedBy	First initial and last name of person reviewing (QA) field data (office exercise).		None	
Review Comment	Comments regarding review of field data (office Exercise).		None	

Assignment Layer Feature Class

This feature class is comes from the most current transportation layer avaliable in the existing GIS. It provides the current management information on file for each road inventoried and allows for input of current condition.

Field	Field Description	Domain	Domain Values	Domain Description
ROUTE_NO	Route ID Number from existing inventory. Do not edit.	None		
RECON_ ASSIGN	Reconnaissance Assignment status. The name of a person or team is entered in this field, in the office, when an assignment is made. When the reconnaissance is completed, the observer edits this field in ArcPad on the GPS unit to indicate the accomplishment.	RECON_ASSIGN	TEAM 1	Recon assigned to Team 1
			TEAM 2	Recon assigned to Team 2
			DONE	The assigned route was surveyed (data was recorded)
			NOT ASSIGNED	Road is not assigned for inventory.
			NOT LOCATED	Site visited - road was not located on the ground (no road prism visible). This may indicate the route has returned to natural conditions or that the route was mapped incorrectly in the GIS.
			NOT IN USE	Site visited - road prism was located but not in use. Completely overgrown with trees and shrubs. Appears the same as decommissioned roads on the ground. Road not surveyed.
			DECOM	Site visited - noted that the existing inventory status is Decommissioned, and confirmed that the route has been physically decommissioned and not in use. Road not surveyed.
			NON-MOTORIZED	Route is a non-motorized trail (not surveyed).
			OWN OTHER	Road is other ownership (i.e., PVT, BLM, BIA, State, County). Road not surveyed.
			Other	Note in comments (e.g., road is blocked by private land, no access, not surveyed).
Recon_Date	Click in date field to record date and time of completion of reconnaissance on the routes.	None		
Observer	Select the observer who entered data into the data recorder.	Observer	S. Bear	Hydrologic Technician
			W. Owl	Forestry Technician
ReviewedBy	First initial and last name of person reviewing (QA) field data (office exercise).	None		
Review Comment	Comments regarding review of field data (office Exercise).	None		
ALL FIELDS BELOW THIS ARE EXISTING INVENTORY DATA FOR REFERENCE PURPOSES ONLY. DO NOT EDIT IN RECON.				
SEG_MILES	Road segment length	None		
NF_LAND	Lies on NF land or private	None		
STATUS	Route status	None		
ROW	Right of way	None		
JURIS	Jurisdiction	None		
PRIM_MAINT	Primary maintainer	None		
SURF	Surface type	None		
CFF CODE	Cartographic Feature File code	None		

Field	Field Description	Domain	Domain Values	Domain Description
SYSTEM	System	None		
OPE_MTC	Operational maintenance level	None		
LANES	Number of lanes	None		
MGT	Travel Management designation	None		
COMMENT	Comments in Forest GIS layer	None		
SEASON	Allowable season of use	None		
UNIQUE_ID	Unique identifier in Forest GIS layer	None		
Mod_Date	Date this record last modified in Forest GIS layer	None		
Check_in	For use check in use	None		
QC	For quality control use	None		
Comments	For inventory update comments	None		

Appendix B: Field Forms

Form Instructions

The following instructions are guidance for completing the five forms needed to collect and record data.

Header Information for all Forms

The forms may have some or all of the fields listed—in the table—below in the header.

Completely fill out each header item including the page numbers. Number the pages when the inventory is complete for an entire road. Organize them in order of form number making sure to keep the HCS sketches with their associated HCS.

Header Item	Description
Watershed Name (HUC 6)	Document the watershed name at the HUC 6 level. Consult the local hydrologist for the most current watershed data.
Route ID	Document the route ID from the most current transportation GIS layer available. Include leading zeros if they are present in the GIS.
Project/Survey/Route Description	Document the current project or survey this inventory was conducted for, or a route description.
Date(s) Start/Finish	Document the date(s) of the survey. Some routes may take more than one day to complete in this case document the start and finish date on the form.
STF Routes (MGT field value)	In the current GIS transportation layer identify the type of route from the MGT field and document on the form.
Observers	Document the field crew observers name with a first initial and last name (e.g., S. Bear, W. Owl).
HCS Section	Document the two-digit HCS section number.
HCS Segment	Document the two-digit HCS segment number.

Form 1 – Road Streaming

The road steaming form is for documenting the general information on each road section. This form also represents an overview of the entire road inventoried.

Header Item	Description
Date	Enter the date the section was surveyed.
Section Number	Enter the two-digit section number.
Begin and End GPS Point	Enter the unique ID number associated with the GPS road point collected.
Surface Type	Enter the road surface type from the list provided.
Design Vehicle	Enter the design vehicle from the list provided.

Current Vehicle	Enter the current vehicle from the list provided.
Traffic Volume	Enter the traffic volume from the list provided.

Form 2 – Hydrologically Connected Segments (HCS Data)

Collect each incidence of erosion type and its length in feet on the HCS worksheet. Total each erosion type in the distance totals box and record that data in the GPS unit. Note if there is diversion potential do not collect and record fill dimensions. See the following erosion form descriptions for guidance.

Large Erosion Features

Single Erosion Point - Large slump/slide, slope failure, or complete/partial washout. Indicate what type of erosion and estimate the sediment volume in cubic yards (see form for list of erosion types). Document the erosion type and estimated volume in the large-soil-loss box on the form.

HCS Percent Road Grade

Document the percent grade and the distance on the HCS % road grade portion of the form. It may be necessary to collect more than one measurement to account for change in slope along the segment - document each percent grade and distance separately. Calculate the weighted average

Weighted Average calculations:

1. Multiply the distance by the percent grade for each individual measurement.
2. Complete above for all measurements taken.
3. Add the answers above and divide by the total distance measured.
4. Round the percent grade to the nearest whole number and enter in the GPS unit.

Road Surface Erosion (LB, RB and NS)

The following road surface erosion should be entered on the form for LB, RB and NS where applicable. Collect the distance in feet for each erosion feature and document on the worksheet.

- Sheet Erosion (sheet wash erosion)
- Rill or Small Gully Erosion (< 12" deep)
- Medium Gully Erosion, 12"-24" deep (min. 6" wide)
- Large Gully Erosion, > 24" deep (min. 6" wide)
- Small Rut (wheel tracks < 6")
- Large Ruts (wheel tracks > 6")
- Inside Ditch Erosion
- Diversion Potential (at stream crossings)

Form 3 – Hydrologically Connected Segments (HCS Sketch)

This HCS form is for sketching an HCS that is not typical or confusing. Follow the sketching instructions on the form using the legend provided. If additional legend items

are needed, make sure they are documented in the legend box. Attach this form to the associated HCS Form 2.

Form 4 – Drainage Structure

The drainage structure form is for documenting all cross drain culverts and road stream crossings. Complete each field, if a field is N/A draw a line through the box to indicate that it was not overlooked. Use the lists and instructions provided on the form to complete each field.

Form 5 – Photo Log and Comments

Use the photo log and comments to document all photos taken for the inventory. Indicate the section, segment, unique ID (UID), photo ID (see naming convention, Appendix A) where applicable. Complete each field, if a field is N/A draw a line through the box to indicate that it was not overlooked. Include a detailed comment explaining photos or unique situations observed in the field.

Blank Forms

Blank forms are saved in a separate document (Motorized_Road_Trail_Forms_30AUG2011.pdf).

Appendix D: References

Coe, D.B.R. 2006. Sediment Production and Delivery from Forest Roads in the Sierra Nevada, California. Colorado State University. Masters Thesis. Fort Collins, CO.

USDA Forest Service 2004. Water Erosion Prediction Project. Rocky Mountain Research Station. WEPP Version 2004.01.26. Moscow, ID.

USDA Forest Service 2009. The Geomorphic Road Analysis and Inventory Package Data Collection Method. Rocky Mountain Research Station, Boise Aquatics Sciences Lab, Boise, ID, 100 pp.

USDA Forest Service 2008. Soil and Water Road Condition Index – Desk Reference. National Technology and Development Program, 0877 1807—SDTDC, 26 pp.